WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL

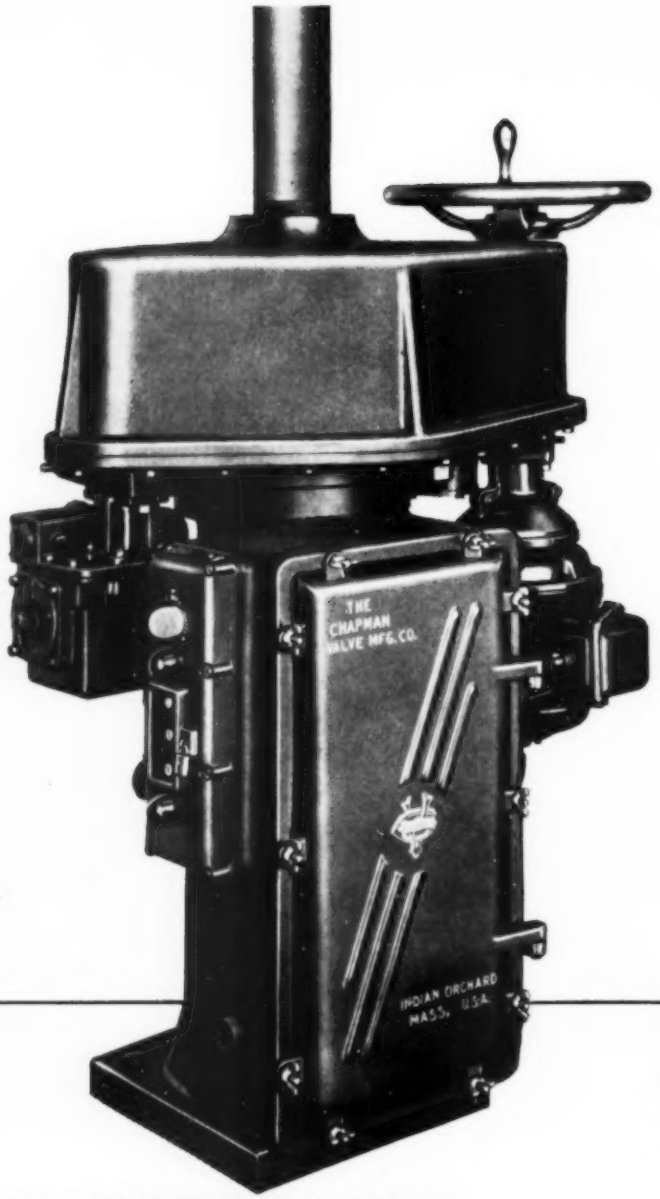
December, 1953

Well Rejuvenation . . .

By combination of Calgon treatment and surging.

SMART OPERATOR

for Valves, Gates and Floorstands



CHAPMAN'S MOTOR UNIT

Instant control of valves and large sluice gates at the touch of a button . . . that's what you get with Chapman Motor Units on the job. Completely housed and thoroughly dust and weather proof, these units are built "to take it" for years, on the roughest service. They're designed for simplicity and extreme ruggedness, as shown by internal view above.

Chapman Motor Operated Floorstands are delivered to the job with all internal wiring complete, so all the wiring to be done is to bring the power leads into the connection box... saving time and money in installation and assuring proper operation. Write for Catalog No. 50.

The Chapman Valve Manufacturing Co.

INDIAN ORCHARD, MASSACHUSETTS

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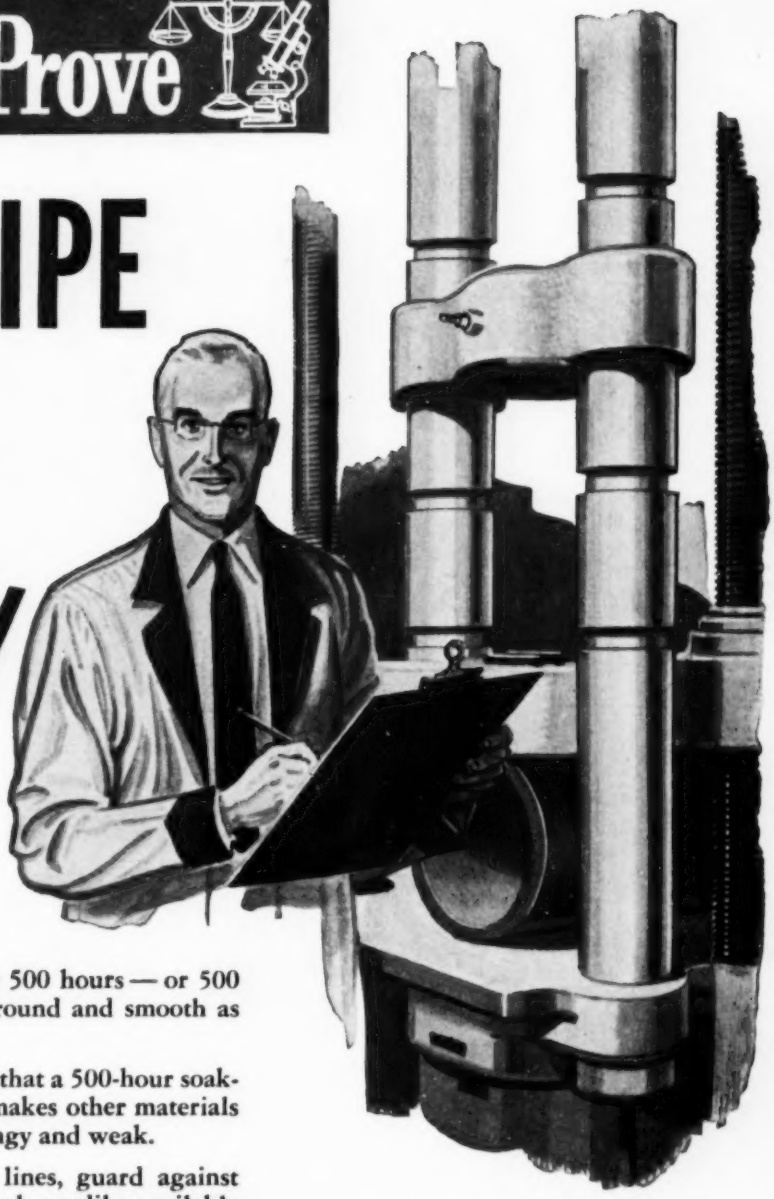
Tests Prove

CLAY PIPE can't get Spongy



Clay Pipe can carry detergents for 500 hours — or 500 years — and it stays as hard and round and smooth as the day it was made.

Comparative laboratory tests show that a 500-hour soaking in a hot solution of detergent makes other materials sometimes used for sewer pipe spongy and weak.

When you plan or install sewer lines, guard against "squash-outs." Insist on non-critical, readily available Vitrified Clay Pipe. It's the one pipe you can always count on — for prompt delivery, resistance to chemical action, and dependable performance. *It's guaranteed for 50 years!*

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CLAY
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PIPE

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MATHIESON CHEMICAL CORPORATION
Mathieson Industrial Chemicals Division
Baltimore 3, Maryland

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WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

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"WATER WORKS PRACTICES" are discussed in a continuing series of articles by *"Doc" Symons.*

"SEWAGE WORKS PRACTICES" are discussed in a companion series by *Prof. Don Bloodgood.*

VOL. 100 **December, 1953** No. 12

Safety in Sewage Works Maintenance and Operation (Part VI) 465
by LeRoy Van Kleeck, *Hartford, Conn.*

How to Buy and Use Lime as a Neutralizing Agent 468
by Richard D. Hoak, *Pittsburgh, Pa.*

Increasing Well Yields 474
by Louis R. Caplan, *Washington, D.C.*

Report of the S&IW Federation's 26th Annual Meeting in Miami 478

Water Works Practices—Source of Supply (Part III—Impounding Reservoirs) 483
by George E. Symons, *Larchmont, N.Y.*

N.Y. Section A.W.W.A. Meets at Lake Placid 487

Sewage Works Practices 491
No. 5 Screening and Shredding Units and Disposal of Screenings
by Don E. Bloodgood, *Lafayette, Ind.*

Recovery of Polluted Streams 495
by C. J. Velz, *Ann Arbor, Mich.* and Seth G. Hess, *New York, N.Y.*

How Sanitary Biologists Contribute to Waste Treatment Processes 502
by John N. Wilson, *Portland, Ore.*

Two Governors Participate in Ground Breaking For Cincinnati's $22,000,000 Sewage Treatment Plant 505

Report From Abroad 506
by John Finch, *Rotherham, England*

Meetings Scheduled 80A

Manufacturers' and Equipment Items 92A

Literature and Catalog 116A

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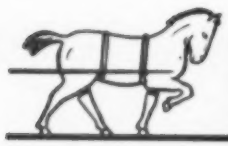
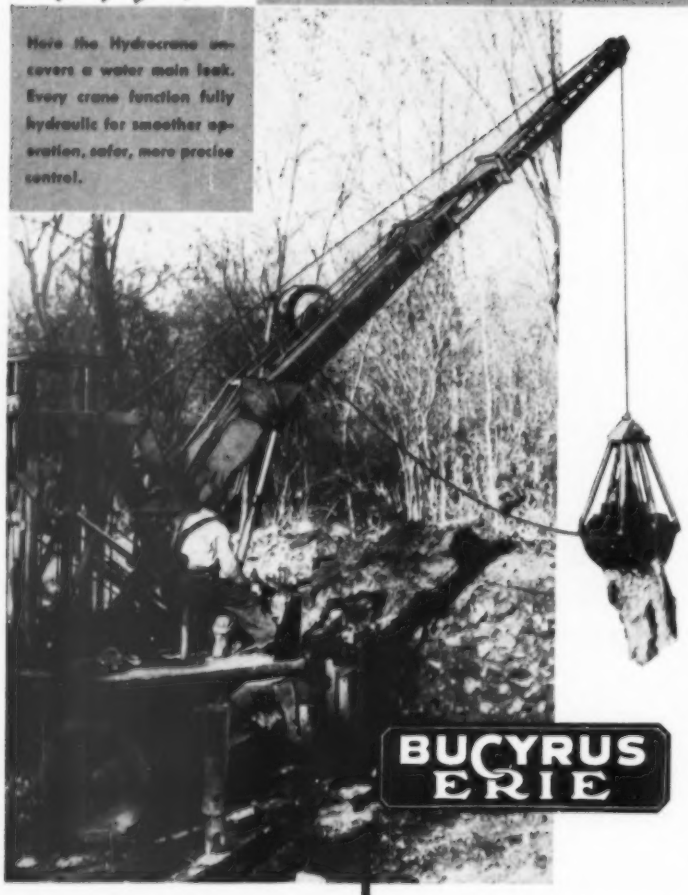


WORKHORSE on Routine Jobs

RACEHORSE on Emergency Calls

Here the Hydrocrane uncovers a water main leak. Every crane function fully hydraulic for smoother operation, safer, more precise control.



The versatile Bucyrus-Erie Hydrocrane is a proved money saver on countless sewer and water department jobs, day-in, day-out. It does them quickly, smoothly, economically.

AND IN AN EMERGENCY IT'S A REAL "LIFESAVER". LOOK:

On hurry-up calls, operator can wheel the compact Hydrocrane through traffic almost as easily as he would an automobile. Telescoping boom fits snugly over cab instead of bobbing out behind. On open highway he can step 'er up to 50 mph — save precious minutes that often save close-budget dollars.

As soon as it reaches the job site, the Hydrocrane whips into action. Outriggers extend hydraulically in seconds—providing a firm, solid working base. No time out for cribbing or blocking. Short tail swing and maneuverability make it the choice for close quarter work.

Busy As A Bee—

This Free Book Tells Why!

Pictures tell the story of 82 Hydrocrane and Hydrohoe applications in this handsome booklet. Write for your copy now.

QUICK CONVERTIBILITY ANOTHER ADVANTAGE

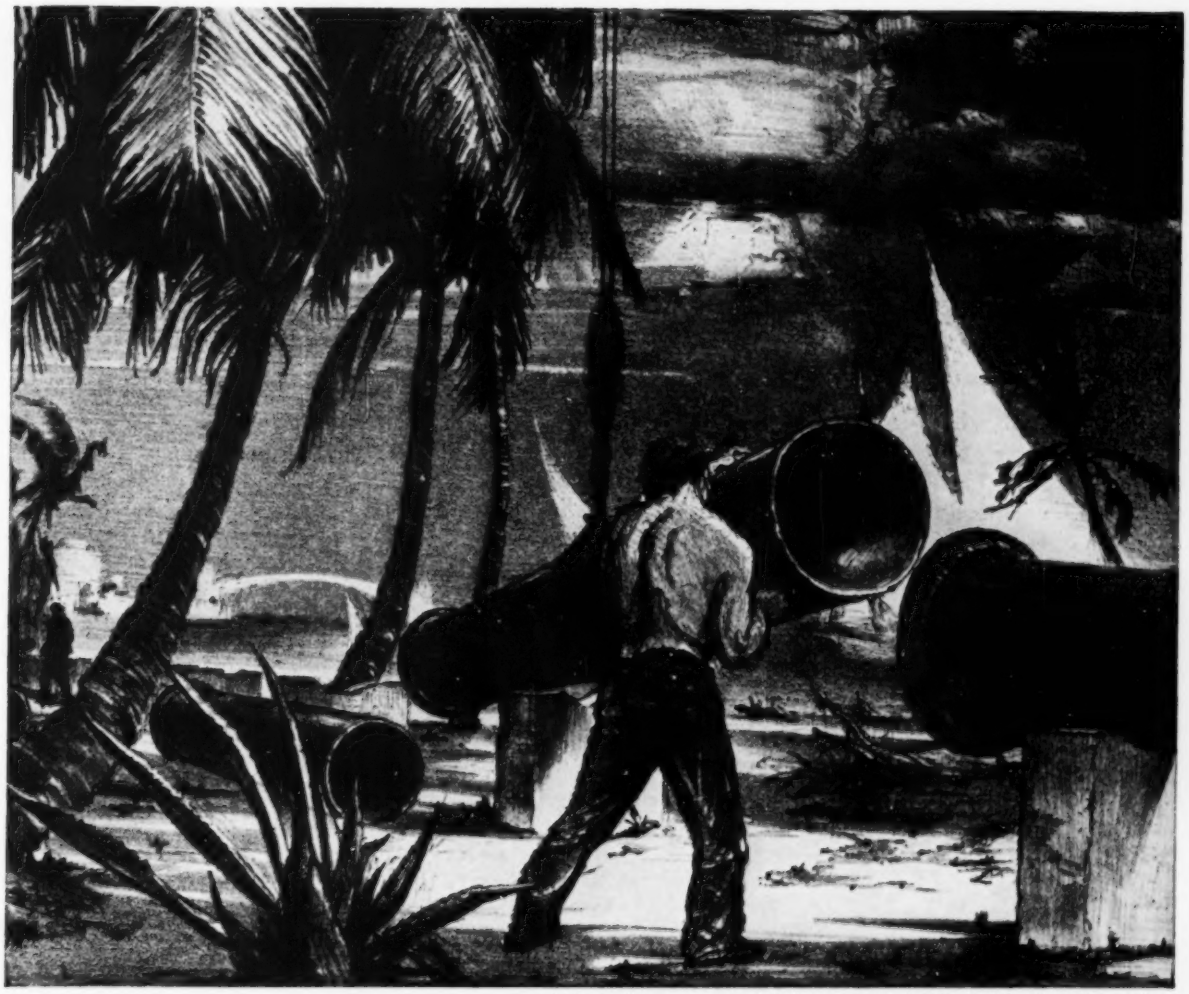
If the job calls for a dragshovel the Hydrocrane can be converted to Hydrohoe front end by one man in "jig time." Owners report making this conversion in *less than one man-hour.* Even when time is short such speedy convertibility makes it practical to change attachments.

22H53

Join the growing list of enthusiastic Hydrocrane users. See your Bucyrus-Erie Hydrocrane distributor for a demonstration on your job.

BUCYRUS-ERIE COMPANY

SOUTH MILWAUKEE, WISCONSIN



Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A. N. A.

WHEN THE GROUND is unstable or a definite grade has to be maintained cast iron pipe is frequently laid on piers or pile bents. Whether above ground or underground there are installations of cast iron pipe with continuous service records measured in generations.

We are well equipped to furnish your requirements for cast iron pipe and fittings made in accordance with American Standard, Federal and American Water Works Association specifications. U. S. pipe centrifugally cast in metal molds is available in sizes 2- to 24-inch and pit cast pipe in the larger sizes with bell-and-spigot, mechanical, flanged or other types of joints.

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Dual electrical system assures reliable power at Elm Fork

Completion of the Elm Fork Water Purification Plant represents a major stride in the water works expansion program at Dallas, Texas. Costing eight million dollars, this outstanding installation doubles the city's purified water supply. It boosts total plant capacity to 200-mgd.

Reliable electrical service at Elm Fork is assured by a secondary selective radial distribution system—adapted by Dallas' engineers, in collaboration with the consulting engineers and Westinghouse. Duplicate primary feeders, bus, transformers and switching equipment are provided. Thus, should a feeder or transformer fault occur, service is restored quickly to all loads.

Compact and unitized Westinghouse equipment was chosen for the Elm Fork system. It conserves building space . . . simplifies maintenance due to accessibility of breakers . . . can be expanded easily as loads grow.

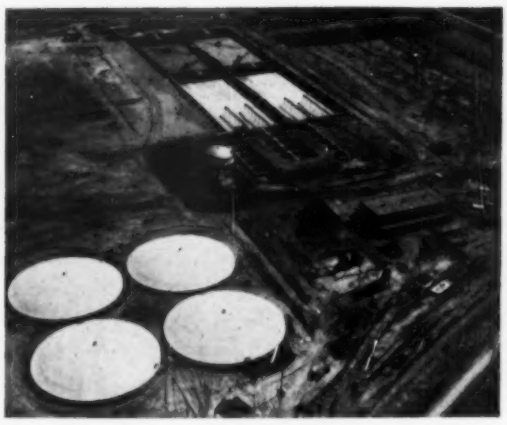
You can profit from this same kind of assistance. Whether the program calls for expansion or modernization, Westinghouse engineers are ready to help you and your engineers adapt a distribution system . . . and match it with a complete line of co-ordinated equipment.

For full details call the Construction Application Engineer at your local Westinghouse Office. Or write direct to Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

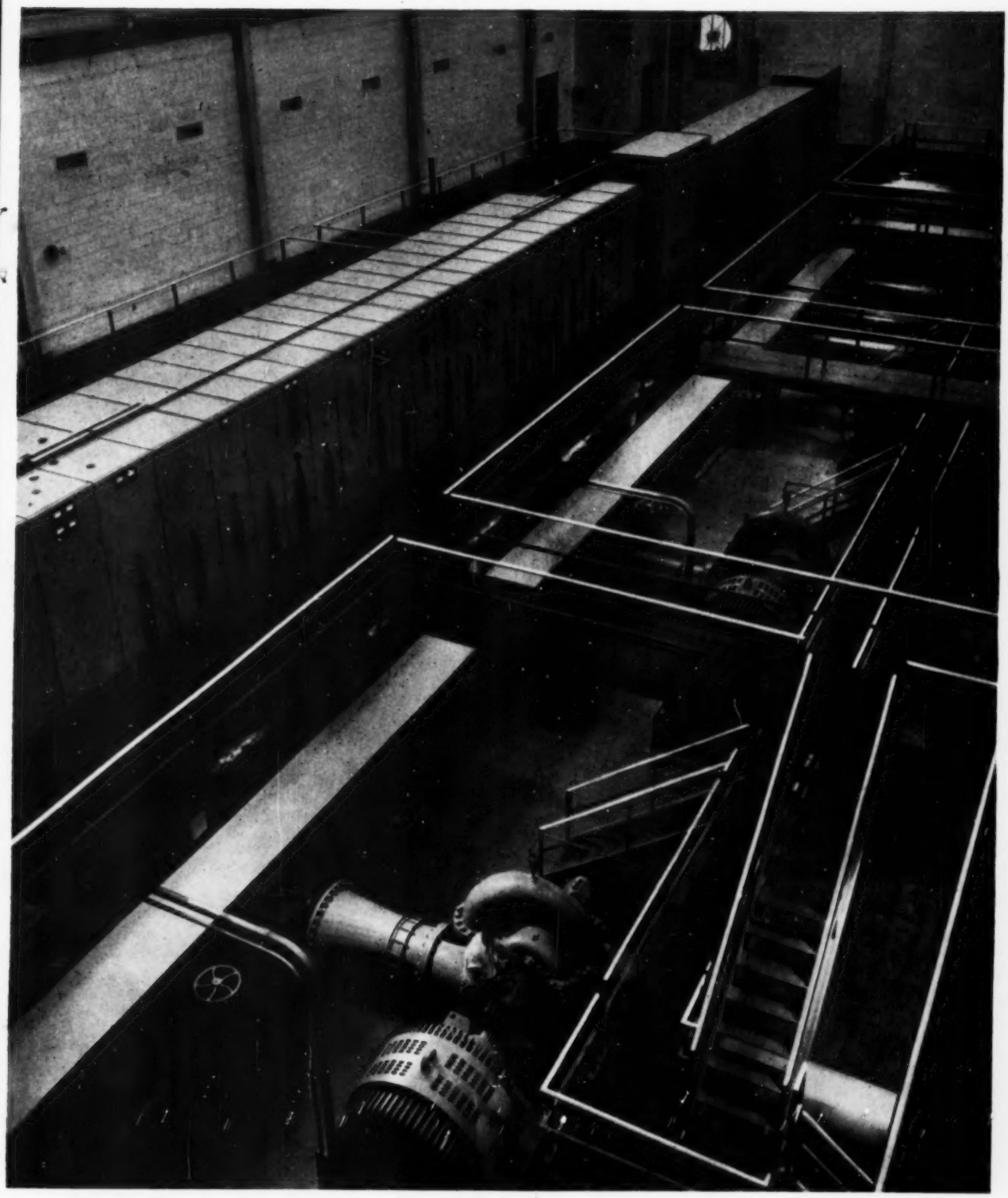
J-94993

YOU CAN BE SURE...IF IT'S Westinghouse

Westinghouse Battery Charger Board controls motor-generator sets which charge batteries. These supply d-c power to the swichboard relays as well as other devices in the Elm Fork electrical distribution system.



Elm Fork Water Purification Plant doubles the Dallas, Texas water supply. Along with new mains, added recently, it can be expanded easily in the future. Consulting engineers for the project: Myers & Noyes.



Westinghouse Metal-Clad Switchgear is mounted in a single line, over 100 feet long. This permits maintenance of circuit breakers and transfer of loads from front of switchboard, without power loss at any point.

How the best product in its field has been made still better

Not overnight, of course—but by a series of improvements gained through research and development resulting in *modernized* cast iron pipe. Tougher, stronger, tuberculation-proof pipe with sustained carrying capacity. Centrifugally cast and, when needed, centrifugally cement-lined.

All of our member companies have centrifugal casting facilities for producing tougher, stronger *modernized* cast iron pipe. All can supply this pipe with cement lining centrifugally applied, resulting in sustained carrying capacity, reduced friction loss and lower pumping costs.

If you want the most efficient and economical pipe ever made for water distribution, your new mains will be laid with *modernized* cast iron pipe with either bell-and-spigot or mechanical joints. Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3.

CAST Q IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

Modernized **cast iron**

This cast iron water main, uncovered for inspection, is in its 106th year of service in Boston, Mass.—one of more than 45 cities with century-old water or gas mains in service.

pipe

for Modern Waterworks Operation

Valves Installed in 1907 Never Out for Repairs

VALVE SERVICE RATINGS

SUITABILITY:	Couldn't be better
FEATURES:	Non-jamming double disc
MAINTENANCE COST:	Almost nil
SERVICE LIFE:	46 yrs. – Still O.K.
OPERATING RESULT:	Economical, trouble-free service
AVAILABILITY:	Regular item – Current No. 2485

In the Brackenridge Borough, Pa., municipal water plant, having forty large Crane iron body double disc gate valves on services up to 90 pounds pressure.

THE CASE HISTORY

How wisely Brackenridge Borough water utilities engineers chose valves in 1907 is self-evident. Today, 46 years later, the forty original Crane valves installed are still on the job—still giving completely satisfactory service. What's more, except for occasional repacking, none of the valves have needed repairs of any kind. And indications are, many years of service remain in the valves.

Valves that set performance records like this aren't bought on price alone—it's assurance of quality that counts in buying. That's thrifty buying—the only way to get best value.

THE VALVE

Highly developed for extra durability and dependability, today's Crane A.W.W.A. valves help water utilities operate efficiently now and in the future. Available in flanged or hub ends up to 36-in. size, these valves permit complete standardization. See your Crane Catalog or your Crane Representative.

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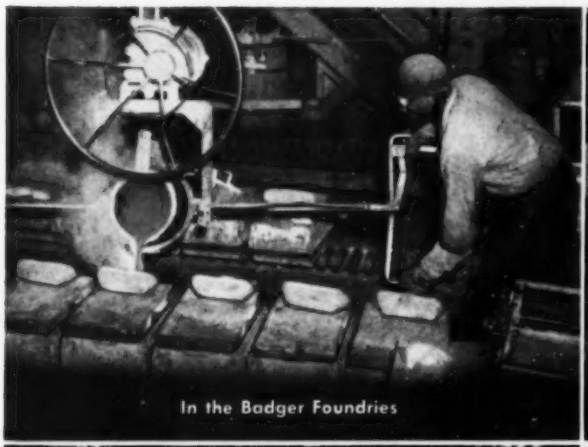
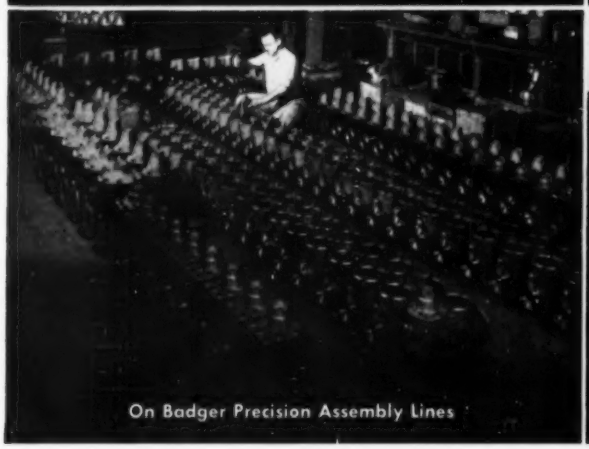
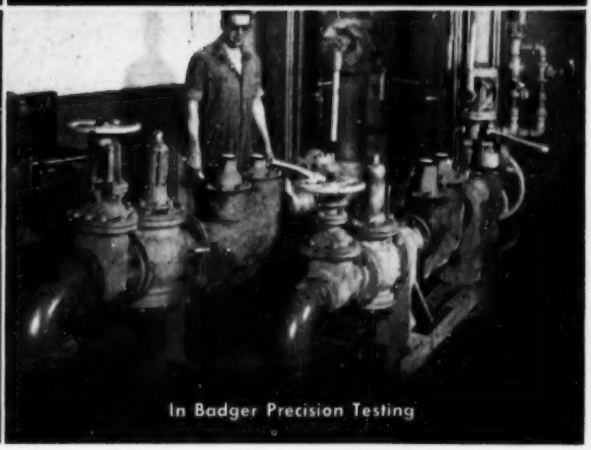

In the Badger Foundries

In Badger Precision Machine Shops


On Badger Precision Assembly Lines


In Badger Precision Testing

From start to finish of every type and size of Badger Meter
precision and quality are Badger-Controlled

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First for Accuracy • Low-Cost Maintenance • Durability • Sensitivity

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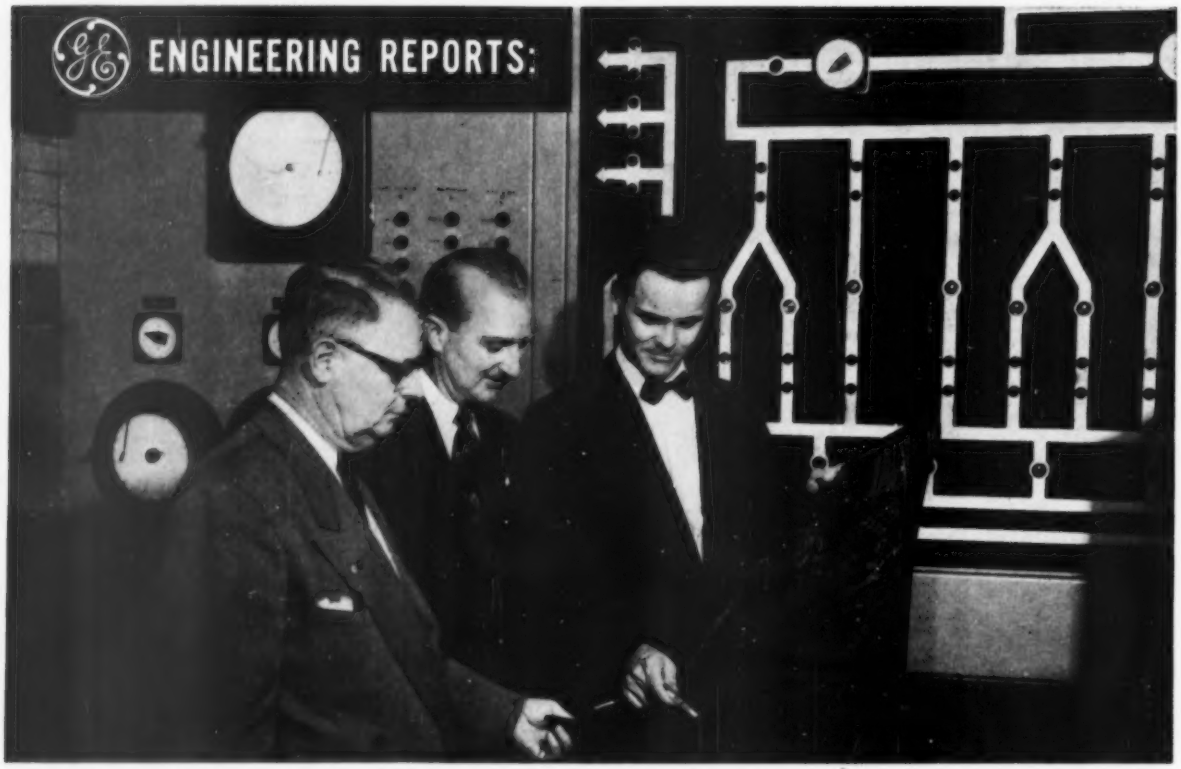
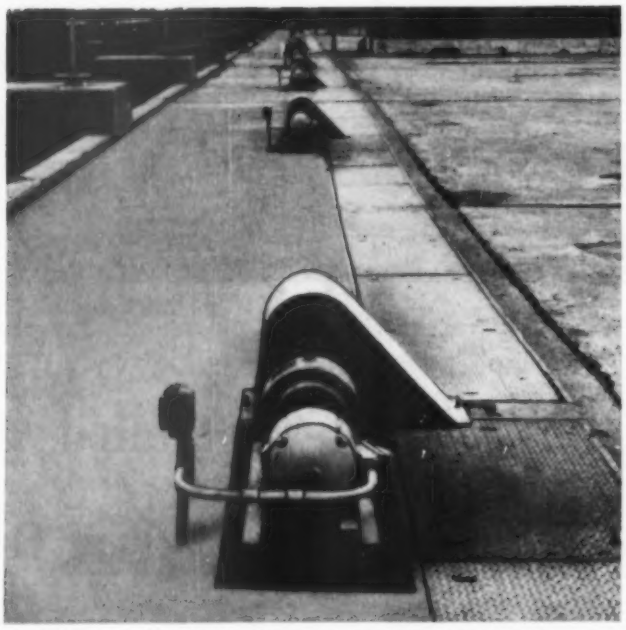
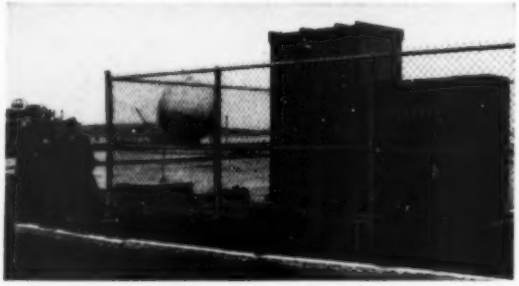


G-E APPLICATION ENGINEER A. L. Hammett is shown examining diagram of sludge-digester tank with Wm. McRoberts, senior electrical engineer of Boston's MDC Construction Division and H. R. Acres, G-E Sales Engineer (r. to l.). According to Mr. McRoberts, "We are favorably impressed with the operation and the low maintenance requirements of the General Electric equipment." In background is G-E flow diagram panel of unique plant system.

Boston takes major step in



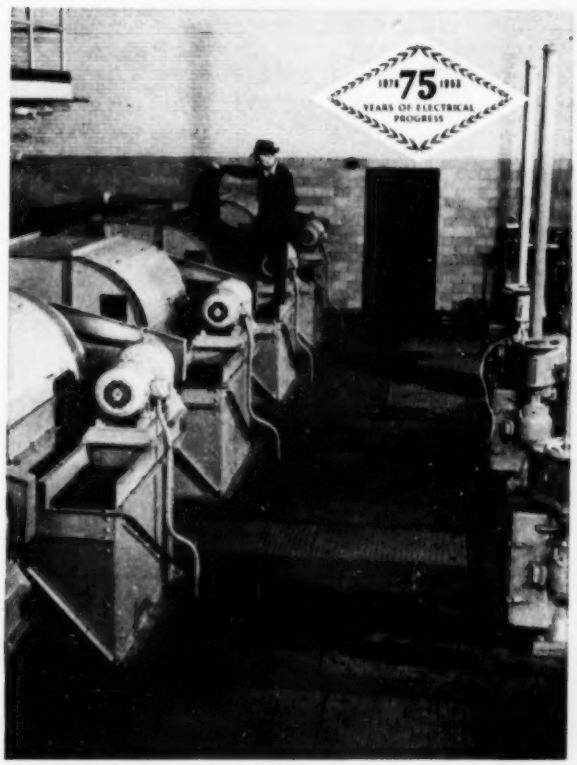
12 SLUDGE COLLECTORS, driven by G-E Tri-Clad TENV motors, pull sludge from six underground tanks into trough, from which it is transported to digester tanks where gas is extracted.



UNIT SUBSTATION steps down power from 2400 to 480 volts for the outdoor collector drives and sludge pumps.

MAIN MOTOR CONTROL CENTER, one of five in plant, controls 26 pumps, compressors, and purifiers. This G-E 480-v panel is located in basement of main building.

2400-V POWER is distributed from this G-E switchgear—heart of the electrical system—to four main pumps controlled by limitamp panel. Nut Island's senior civil engineer, A. J. Griffin, is shown taking readings from switchgear panel.



SYSTEM BEGINS in grit room where raw sewage flow is controlled by six gates (three shown at right) and passed through six grit collectors (four shown at left). Both gates and grit collectors are powered by G-E Tri-Clad* induction motors.

plan for CLEAN WATERS

New Nut Island treatment plant is first half of plan to make harbor recreation areas safe

When Boston's new Nut Island sewage treatment plant at Quincy goes into full-scale operation this year, it will have a maximum capacity of 300-mgd and will be the first half of a long range plan to make Boston Harbor waters safe again for bathing and recreation. In the near future, another plant will be built at Deer Island which will eliminate pollution in the entire harbor.

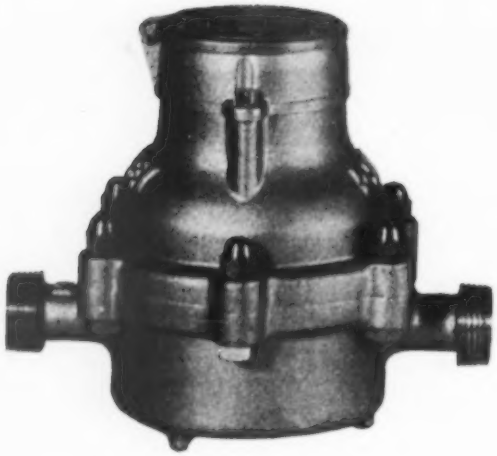
The Metropolitan District Commission—Construction Division (F. W. Gow, Chief Engineer) of Boston, designer of the plant, Anderson-Coffey Co., Inc., electrical contractor, and Thomas O'Connor, general contractor, were aided in pre-construction electrical planning by G-E application engineers, who helped design the entire electrical system, specify standard equipment, and supervise installation.

Specialists in sewage-plant electrification, G-E application engineers are ready to work with *your* engineers and consultants. Backed by unexcelled engineering facilities, they'll help in designing a coordinated electrical system for your new plant or modernization project. Contact your local G-E Apparatus Sales Representative early in the planning stage. Ask him how you can put G.E.'s CLEAN WATERS program to work in your community. General Electric Company, Schenectady 5, N. Y. 666-78

*Reg. Trade-mark of General Electric Company

Engineered Electrical Systems for Sewage Plants

GENERAL ELECTRIC



Hersey
Disc Water Meter
MODEL HD

Particularly designed for use in areas where non-freezing conditions exist

There are no substitutes for HERSEY WATER METERS

Hersey
Disc Water Meter
MODEL HF

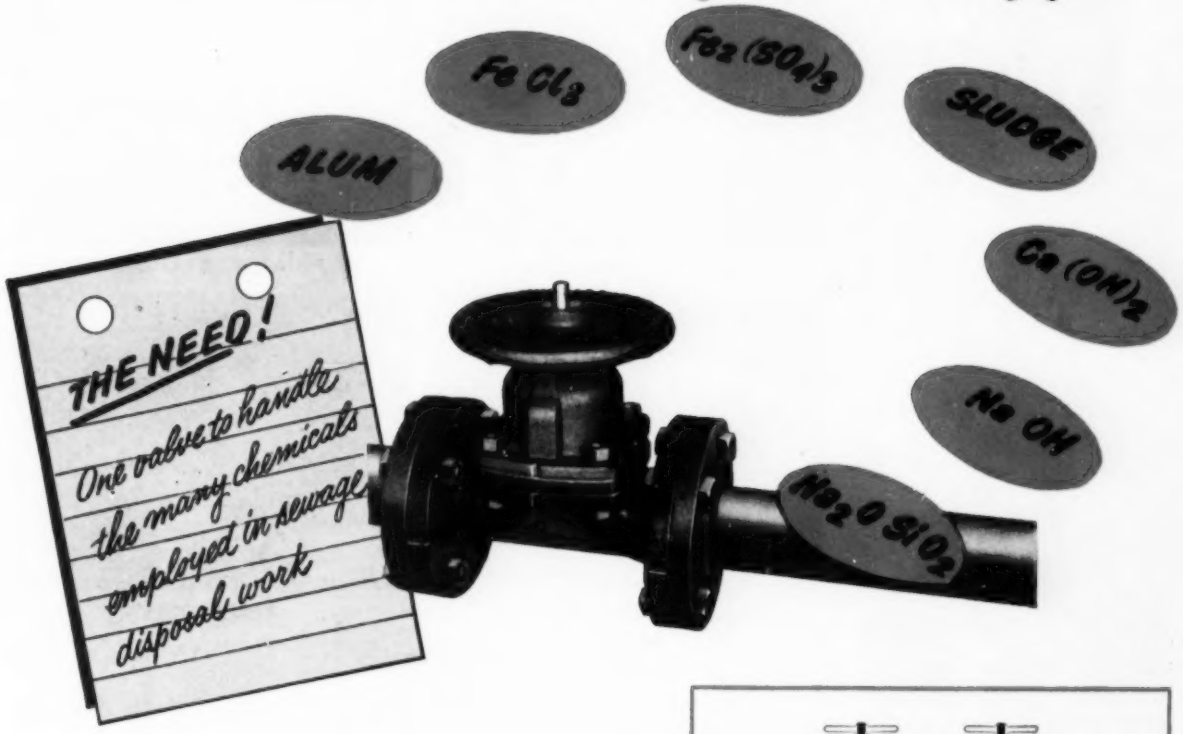
Particularly designed for use in areas where freezing conditions may be encountered

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO
SAN FRANCISCO — LOS ANGELES

What valve would you specify?

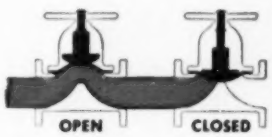


It takes a versatile valve to "fill the bill" in water, sewage and industrial treatment plants. Grinnell has this valve. It's the famous Grinnell-Saunders Diaphragm Valve.

This unique Grinnell valve, though employing only a single basic design, provides a wide choice of body, lining and diaphragm materials.

For example, on lines handling filter alum, either glass or rubber lined Grinnell-Saunders Valves, equipped with neoprene diaphragms, may be had. For sodium silicate, an iron bodied valve, with neoprene diaphragm, is recommended.

Yes, the amazing adaptability of the Grinnell-Saunders Diaphragm Valve in handling highly corrosive fluids, gases, compressed air, beverages, foods and suspended solids . . . in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors . . . explains its acceptance by industry after industry. For further details, write for Grinnell-Saunders Diaphragm Valve catalog.



Features which have made Grinnell-Saunders Diaphragm Valves the specified valve in many different industries:

Streamlined flow. Smooth, streamlined passage, without pockets. Frictional resistance at a minimum.

Leak-tight closure against grit, scale, suspended solids.

Working parts absolutely isolated from fluid. Diaphragm completely seals off working parts from fluid in the line.

Body, lining and diaphragm materials to meet service condition. Bodies stocked in cast iron, malleable iron, stainless steel, bronze and aluminum; other materials on special orders. Valve bodies lined with lead, glass, natural rubber or neoprene. Diaphragm materials of natural rubber or synthetics.

Minimum maintenance. No refacing or reseating is required. No packing glands to demand attention. New diaphragm can be inserted without removing valve body from the line.

GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
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DARLING VALVES

Serving Municipalities and Public Works everywhere

FILTRATION PLANTS

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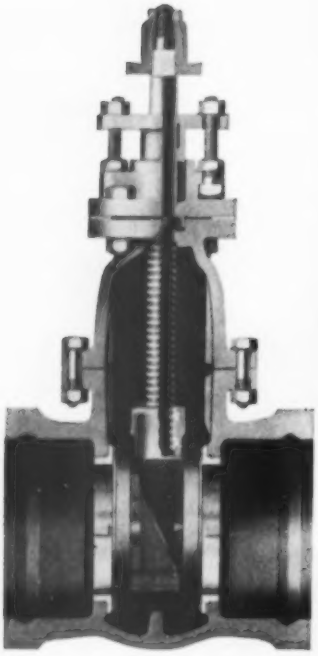
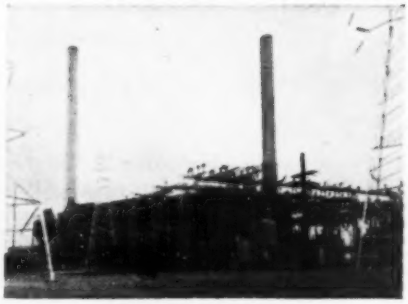
RESERVOIRS



Note rugged simplicity of this unique Darling principle—just four sturdy working parts . . . two plain interchangeable no-pocket discs and two husky wedges. With this foolproof assembly, maintenance is easy.

SEWAGE PLANTS



POWER PLANTS

DARLING Revolving Double Disc VALVES are stand-outs in every application

AN enviable record for outstanding public service . . . and of course there are many good reasons for Darling valve dependability and low-cost service.

1. The *fully revolving double disc parallel seat* Darling valve compensates automatically for any valve body distortion . . . your assurance of tight closure even under extreme service conditions.

2. The *fully revolving double discs* minimize wear and assure you of tight closure throughout the life of the valve.

Water and sewage engineers everywhere are saving time and cutting valve maintenance costs thanks to Darling *revolving disc* gate valves. Darlings are available in a wide range of sizes for all normal and unusual service . . . for pressures up to 1500 pounds. Write for all the facts. *Address* . . .

DARLING VALVE & MANUFACTURING CO.

Williamsport 11, Pa.

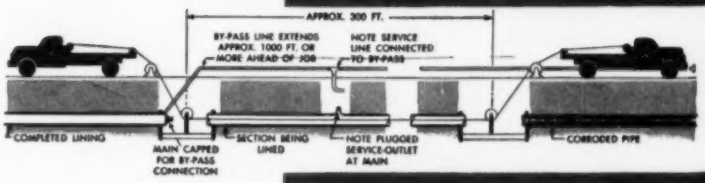
Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario

have you seen an Eskimo pipe?

Practically the only materials available to the early Eskimo for his pipe were bone, ivory and small twigs. The most primitive type of pipe was made by splitting a straight willow wand, removing the pith and hollowing out one end for the bowl, then binding the two hollowed out pieces to form the long stem. Mighty tough smoking for the Eskimo who couldn't enjoy the straight, clean and easy-drawing pipes made today!

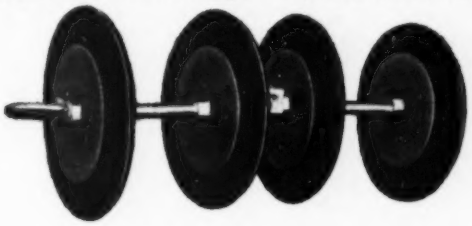
have you seen a modern pipe lining operation?

The Tate Process, applicable to water, oil and gas pipe lines, renews old iron and steel pipe "in place" as shown here in the schematic drawing. The Tate Process is applicable to pipe lines from 4" to 16" in diameter. Only momentary interruption to service is necessary while by-pass sections are installed.


APPROX. 300 FT.
BY-PASS LINE EXTENDS APPROX. 1000 FT. OR MORE AHEAD OF JOB
NOTE SERVICE LINE CONNECTED TO BY-PASS
COMPLETED LINING
MAIN CAPPED FOR BY-PASS CONNECTION
SECTION BEING LINED
NOTE PLUGGED SERVICE-OUTLET AT MAIN
CORRODED PIPE

have you seen the *Steel Scraper?* . . . It is pulled through pipe, dislodges all incrustation, corrosion and tubercles, makes inside clean and smooth.

have you seen the *Rubber Swabber?* . . . It follows the scraper and pulls out loosened material leaving pipe clear and free of debris.



have you seen the *Tate Process liner?*...It completes the renewing process by squeezing cement mortar onto the inside of the pipe wall, making the surface smooth and water-proof. Liquids move swiftly without drag.

If your worn-out pipe looks like this!

The Tate Process restores it like this!

YOU GET THESE ADVANTAGES FROM CEMENT MORTAR LINING!

- ✓ New pipe performance
- ✓ Prevents leakage
- ✓ Restores full flow coefficients
- ✓ Reduces pumping and maintenance costs
- ✓ Protects against corrosion, contamination and discoloration at much less than the cost of installing new pipe!

Pipe Linings, Inc. offers "in place" Tate Process lining service for pipe 4" to 18" in diameter and "in place" Centrifugal Process lining service for pipe 16" to 144". Complete mobile equipment and expert crews are available to bring new efficiency to your old pipes. Pipe Linings, Inc. hydraulic engineers will be glad to discuss your problems. No obligation! Send the coupon today!

PIPE LININGS, Inc.

PIPE LININGS, Inc., 4675 Firestone Blvd., South Gate, Calif.

( ) Please send complete information on how to obtain new pipe line performance from my old pipe.

( ) Please have one of your hydraulic engineers call on me.

Name_____

Title_____

Company_____

Address_____

City_____ State_____

4675 Firestone Blvd., South Gate, California

A subsidiary of American Pipe and Construction Co.

there's an EDDY valve or hydrant to fit the pipe in your water distribution system...

EDDY BELL END VALVE

EDDY BRONZE MOUNTED GATE VALVES

offer simplicity of design, trouble-free operation and enduring service. From the engineering drawing boards through all stages of manufacture, they are step by step a truly "finished" product of workmanship. These factors, added to personal experience, are reasons why progressive water works men have relied on Eddy Valves for years.

EDDY MECHANICAL JOINT VALVE

Two unskilled workmen, using only a ratchet wrench, can quickly install the Eddy Mechanical Joint Valve. Work can be done in a flooded trench or under any weather conditions, for no caulking, no lead-melting is necessary. Every joint is held bottle-tight under pressure. Available in sizes from 3 to 12" for use on both centrifugally-cast and sand-cast pipe.

EDDY BELL END HYDRANT

EDDY BRONZE MOUNTED HYDRANTS

are built for dependability and lasting service. They open smoothly *with* the pressure and close without water hammer. One man can easily remove all operating mechanism for inspection and repair. Positive drip action automatically drains the standpipe, safe-guarding against freeze-ups. Stem held in place below main valve means no water loss due to a bent stem.

Equipped with mechanical joint connection, Eddy Hydrants can be quickly installed, requiring a minimum amount of labor. A ratchet wrench is the only tool needed. Available with or without auxiliary valve.

EDDY MECHANICAL JOINT HYDRANT

Send today for full information on the complete line of Eddy Valves and Hydrants. No obligation.

EDDY
VALVE COMPANY

A Subsidiary of James B. Clow & Sons

WATERFORD, NEW YORK

Freezing Losses Reduced by the SIMPLICITY of FROST BOTTOM AMERICAN METERS

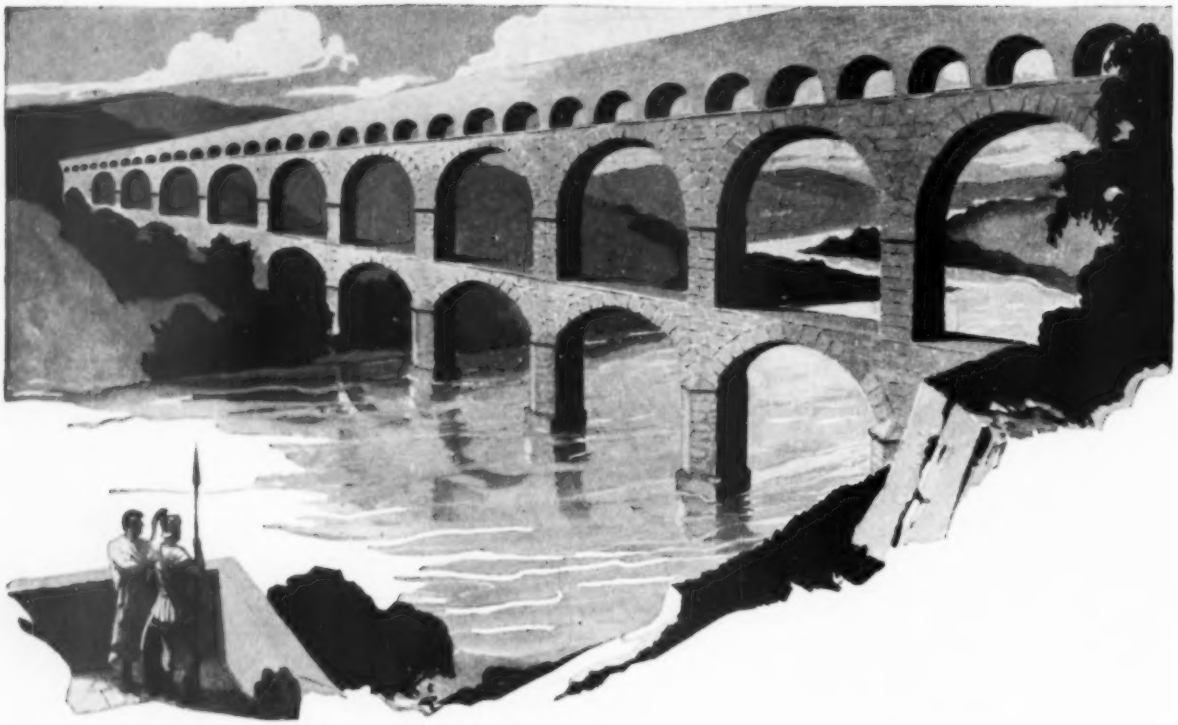
● A freeze-up can mean costly shop repairs or a minor "on-the-spot" change. American Frost Bottom Meters have a simple patented construction that permits the bottom casing to break by tension and relieve the internal pressure in the event of a serious freeze-up.

All the more delicate—most costly parts—including the gear train—are protected. The breaking pressure is pre-tested at the factory. Hundreds of thousands of meters in service are proof of the effectiveness of this design.

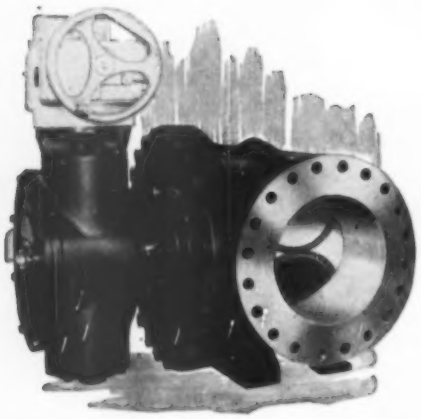
Ask for complete data.

BUFFALO METER CO.

2909 MAIN STREET, BUFFALO 14, NEW YORK



a "Big Inch" of olden days ~



GENIUS has raised her head in every age. So today's Masterbuilders are but the projeny of antiquity's great inventors. Even principles are related. An example of this is the plug cock design for fluid control, embodied in the Smith Rotovalve, which has come down through the ages unchanged! Send for your copy of "Rotovalves by Smith."

If It's Hydraulics - Put It Up to Us!

S. MORGAN SMITH Co.

YORK, PENNA. U.S.A.

YOU CAN MAKE
YOUR PIPELINES

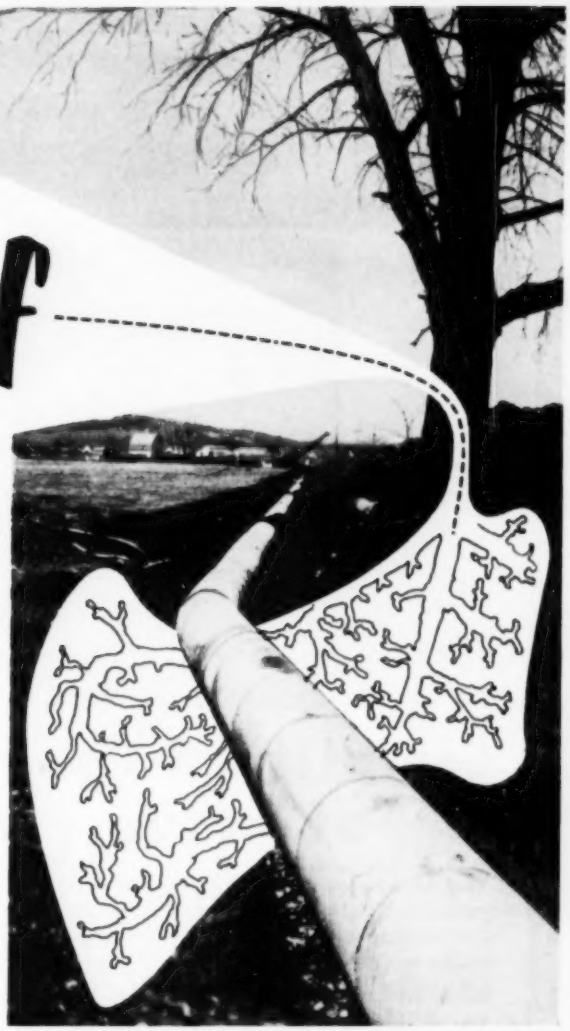
Rootproof

SPECIFY

TYLOX

flexible rubber

SEWER PIPE JOINTS



Protected with TYLOX—The nearby tree will never find a source of water in this concrete pipe sewer . . . This line is TYLOX-proofed against entrance of roots, sediment, or ground water. It won't have to be "dug up" in the future to repair faulty joints.

WHEN you specify jointing materials for your sewerage and drainage pipe jobs, specify TYLOX flexible rubber pipe jointing gaskets and make *sure* your lines are *root-proof,* now, and in the future . . . As every sanitary engineer knows, roots, by nature, seek a water source. If that source happens to be *any* joint in a sewerage or drainage line, roots will work into the pipe and render the *entire* line inoperative. Only costly repair work can correct the trouble.

TYLOX Pipe Jointing Gaskets are the Engineer's surest protection against root troubles in his line . . . Unlike mortar or bituminous jointing materials, TYLOX does not depend upon adhesion to form a seal. TYLOX "packs" the joint's annular space under compression, as the pipe is shoved home. The natural resilience of the rubber *keeps* the joint tight, and neither *immediate* backfill, nor presence of water in the trench during jointing affects this seal.

TYLOX is made of a specially compounded rubber which resists sewage and industrial waste acids, and is virtually ageless. It won't shrink or crumble, to leave spaces for the entrance of roots, ground water or sediment. Under ground, and under compression, it outlasts the pipe itself.

On your next sewerage or drainage project, plan *now* to specify TYLOX RUBBER JOINTS. You'll assure *faster* pipe-laying, and joints that *stay rootproof* "for the life of the line."

1856

Making Joints with TYLOX RUBBER GASKETS is as simple as A B C

Cement tongue and snap on TYLOX gasket.

Lubricate sliding surfaces with TYLOX cement.

Shove the pipe home to line and grade.

Write today for complete specification data and literature on TYLOX Pipe Jointing Gaskets.

HAMILTON KENT MANUFACTURING COMPANY

225 Gougler Ave. KENT, OHIO Tel. 3449

R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •

Simplified Control and Shut-off of Volume and Pressure

The underground application shows a 50-pound R-S Valve with gear reducer, lubricating lines and operating nut which is hand operated with a wrench. Only a few turns of the wrench are required to open or close the valve.

Practically every R-S Valve installation, particularly when automatically controlled, provides useful experience that can be applied in other industries although they may be far apart in classification. It is this accumulation of engineering experience coupled with unexcelled production facilities that can be so helpful to you.

Call the R-S representative at the inception of your application. Benefit by his research and engineering experience in the simplified control and shut-off of volume and pressure.

S. MORGAN SMITH Company • YORK, PA.

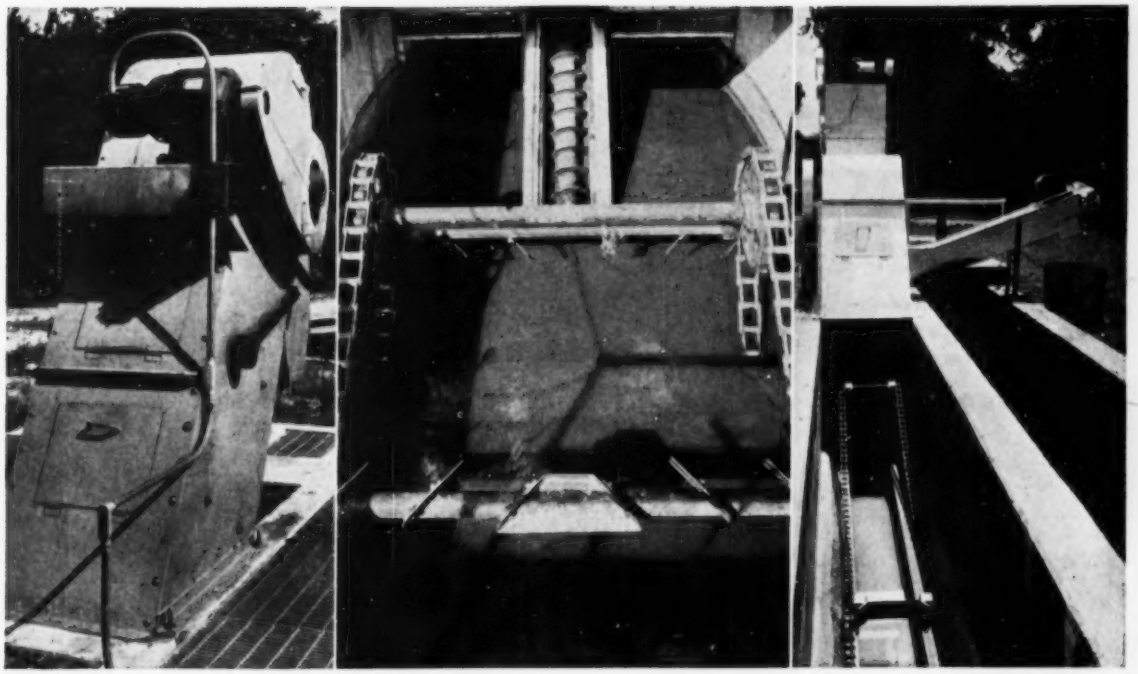
MANUFACTURERS OF HYDRAULIC TURBINES-VALVES

REPRESENTATIVES IN PRINCIPAL CITIES

No. 850—Ten-inch, 300-pound valve equipped with 18-8 shafts, hastelloy bushings, stick lubricators and isolating valves, diaphragm top with handjack and positioner. Installed for the flow control of sour crude petroleum.

No. 801—Three-inch, 125-pound bronze screwed end valve with handlever control and locking device. There is a size and type of R-S Valve for any industry or process.

Catalog No. 20 describes R-S Valves in detail—types, prime movers, applications and specifications. Contains more than 150 illustrations. Write for your copy.



TRITOR SCREENS—At small sewage treatment plants—where grit creates a problem during storm flows, this one machine accomplishes the effective, low-cost removal of both screenings and grit.

STRAIGHTLINE GRIT CHAMBERS—For the removal of a clean, washed grit with a low putrescible content. The complete collection and thorough cleaning operation makes further handling unnecessary.

STRAIGHTLINE GRIT COLLECTORS—On this bucket type collector, water sprays wash the grit from the buckets into a separate washing and dewatering screw. Photo also shows Link-Belt Bar Screen.

How to get flexible, low-cost grit removal

LINK-BELT can give you equipment best suited to your requirements

DON'T let grit plug your pipe lines . . . wear out your pumps . . . take up valuable space in your digesters. Link-Belt builds effective grit removal equipment that assures both low costs and flexibility.

For example, with the Tritor Screen, a grinder may be used to shred the screenings when no grit is received. During storms, the grinder may be by-passed and grit and screenings disposed of by fill, burial or incineration. Similarly, the Straightline grit collector is designed either with a pitched flight collector and dewatering and washing screw discharging direct from the grit chamber—or with a bucket type collector for deep chambers.

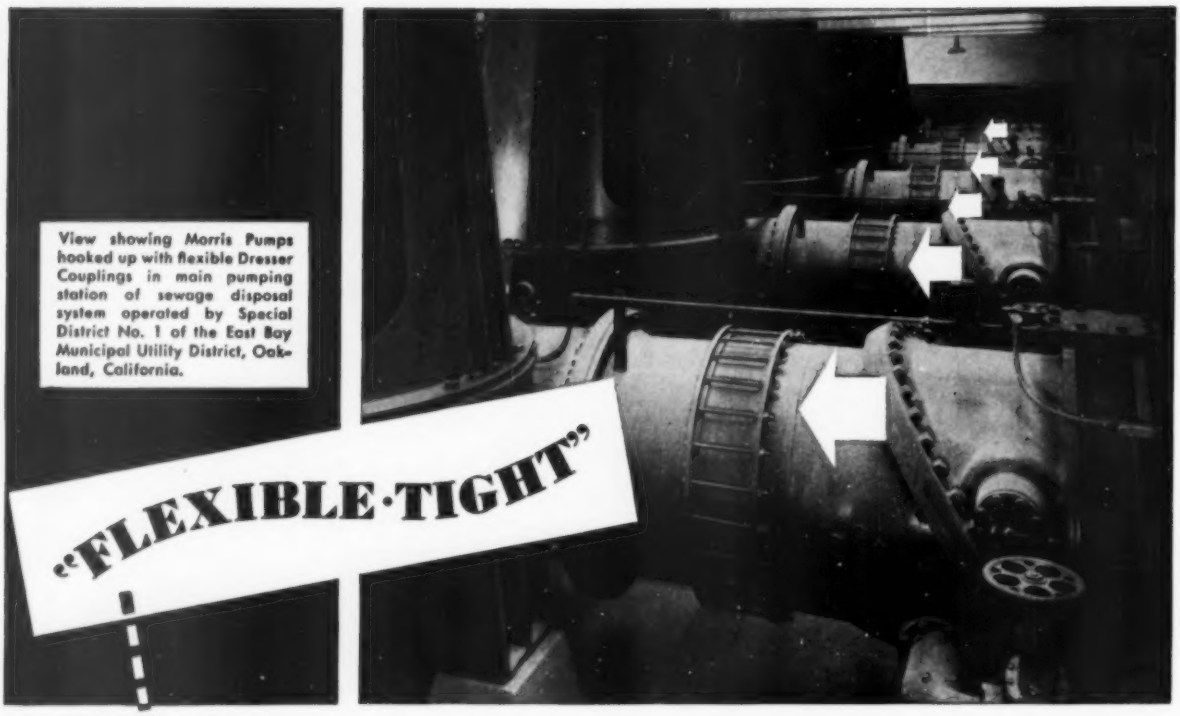
In addition to grit handling and washing equipment, Link-Belt manufactures a complete line of equipment for water, sewage and industrial waste treatment plants. A call to the Link-Belt office near you will put you in touch with an experienced sanitary engineer. He'll work with your engineers, chemists and consultants—help you get the best in modern treatment equipment.

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities.

13.134

LINK-BELT

SANITARY ENGINEERING EQUIPMENT



View showing Morris Pumps hooked up with flexible Dresser Couplings in main pumping station of sewage disposal system operated by Special District No. 1 of the East Bay Municipal Utility District, Oakland, California.

These are profitable connections

Leading pump manufacturers such as the Morris Machine Works welcome Dresser Couplings in their pump installations because these "Flexible-Tight" joints offer four important advantages:

The Dresser Coupling compensates for any slight misalignment of the piping, permitting much simpler and quicker installation.

The coupling is a "must" for dismantling purposes. It permits easy removal and reinstallation of the spool piece.

The Dresser Coupling permits a flush internal pipe connection with minimum turbulence or eddying.

Perhaps one of the most important functions of the Dresser Coupling is to remove entirely any piping strains on the pump casing, avoiding danger of destroying the alignment of the pump.

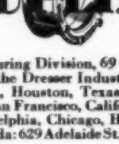
All these advantages stem from the fact that Dresser Couplings are designed to provide a "Flexible-Tight" joint that's easy to install. Resilient, long-lived gaskets harmlessly absorb stresses and strains, protecting pipe and equipment. Proved in use for more than 60 years.

Write today for more information about Dresser applications on water, sewage, and industrial waste projects.

These 67" air mains of the Sanitary District Sewage Works, Chicago, are Dresser-Coupled to provide complete dependability. Leaks could not be tolerated. A fraction of a pound saved in air pressure meant dollars saved in electric power costs. Dressers were selected to assure that saving.

DRESSER®

"FLEXIBLE-TIGHT"

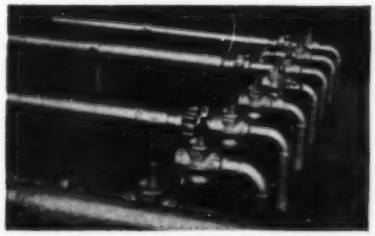


COUPLINGS

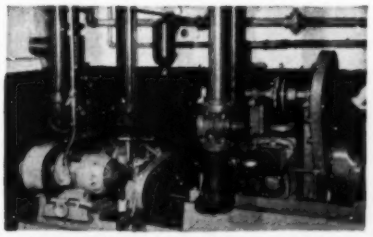
Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, California. Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: 629 Adelaide St., W., Toronto, Ont.

Straight through, clean as a whistle! That's the kind of *flow perfection* you get with an a.c.f. Round Port Valve. Because they're the exact same size and shape as the pipe itself, there are no obstructions. You *always* get full capacity flow of heavy viscous ladings... without loss in head pressure. There are no abrasive effects from solids in suspension.

The full pipe area and non-wedging effects of Round Port Valves are also found in a.c.f. Rectangular Port Valves. Both are designed to give you long, trouble-free service with minimum maintenance. Don't settle for less than the very best. It pays!



The Petroleum Industry finds full-pipe area of a.c.f. Valves of great advantage on both natural gas and crude oil.



In Sewage Treatment Plants the a.c.f. exclusive Cylindrical Plug shears obstructions, provides uninterrupted flow.

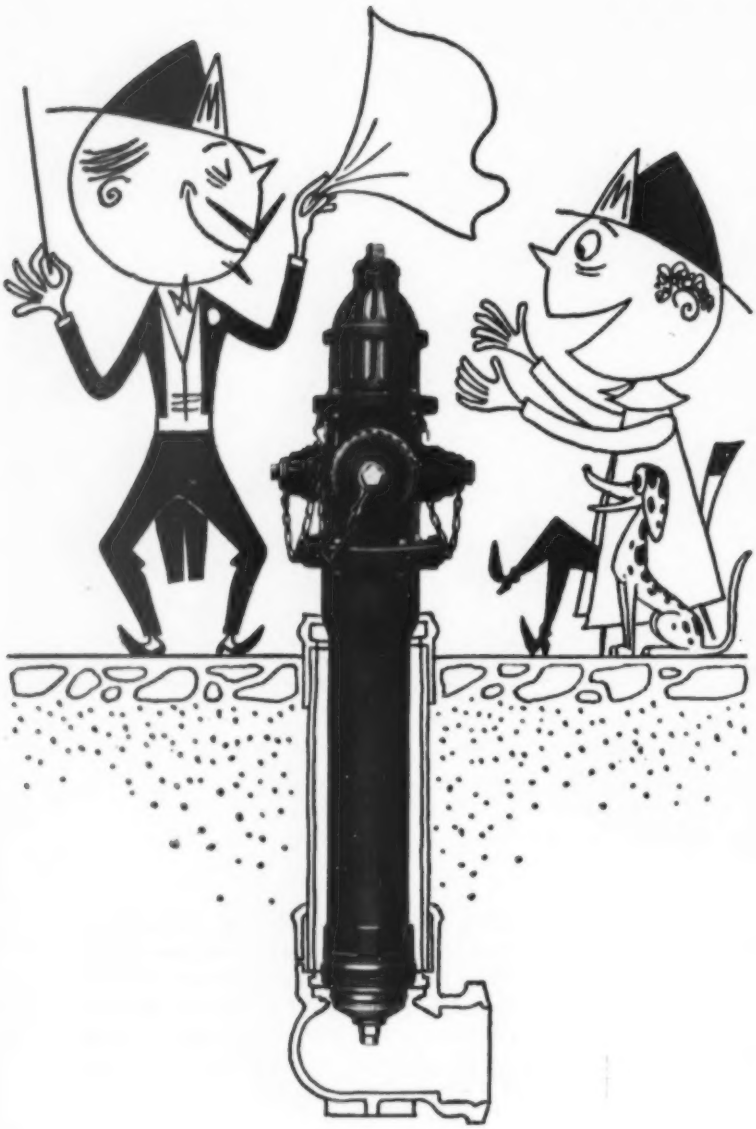
In Processing a.c.f. Round Port Valves are 100% obstruction free, ideal for handling materials in suspension.

a.c.f.

CYLINDRICAL FULL PIPE AREA **PLUG VALVES**

Write for Catalog 4-WS. American Car and Foundry Company, Valve Division, 1501 E. Ferry Ave., Detroit 11, Michigan.

Representatives in 50 Principal Cities



All Working Parts Contained in Removable Barrel... New Barrel Installed in Jiffy

- The barrel, containing all the working parts of the hydrant, is readily removed for inspection or for repair by simply unscrewing from the elbow and withdrawing from the protection case. *No excavating.*

- This exclusive Mathews feature eliminates any need for repair work on the job. A spare barrel can be inserted in a few minutes and the broken barrel repaired in the shop.

- With automobile accidents breaking an increasing number of hydrants, this speed of replacement is of tremendous importance in maintaining community fire protection.

No Other Hydrant Offers So Many Essential Features:

Compression type valve prevents flooding • Head turns 360° • Replaceable head • Nozzle sections easily changed • Nozzle sections easily raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • Operating thread only part to be lubricated • All working parts contained in removable barrel • A modern barrel makes an old Mathews good as new • Available with mechanical-joint pipe connections

MATHEWS

HYDRANTS

Made by R. D. Wood Company

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

150th anniversary

FIRST
in 1000 years

NEVER BEFORE, not even a few short years ago, could the new Fischer & Porter Ratochlor* chlorinator be built!

Why?

Like the jet engine, which could not be born until all the complex alloys and ceramics necessary to resist its great heat were available — like controlled atomic fission, which required complex mathematics and multi-complex mechanics — so the new **F & P** Ratochlor unit needed many new and complex developments of the laboratory before it could be produced for thoroughly dependable use.

With a cabinet completely formed from polymer-impregnated fiber glass, with Uscolite tubing and fittings, with Kel-F, Teflon, tantalum, and silver components, the 1050 series unit is practically impervious to chlorine corrosion.

Offering complete simplicity of operation and freedom from maintenance problems, the new **F & P** chlorinator automatically assures maximum water economy over an extra wide flow range.

These are only a few of the many reasons why this new unit is important to every industrial and municipal user of chlorine. It is the result of years of concentration by **F & P** on the problems inherent in chlorination. Write today for complete descriptive literature which tells the whole story from idea to reality.

Ratochlor units in F & P Hatboro plant awaiting inspection and test *with chlorine* under actual operating conditions.

complete process instrumentation

FISCHER & PORTER CO.

*T.M., F&P Co.

3010 County Line Road, Hatboro, Penn.

2260

Company owned sales and service branches strategically located throughout the world.

turn a tap

Everyone on a water main turns a tap and expects water . . . not excuses.

That's why so many municipal water pumping stations—in small and large communities—have an independent power source.

In addition to providing dependable power in this service, Fairbanks-Morse Diesel and Dual Fuel engines are reducing pumping costs—in some cases as much as 60%.

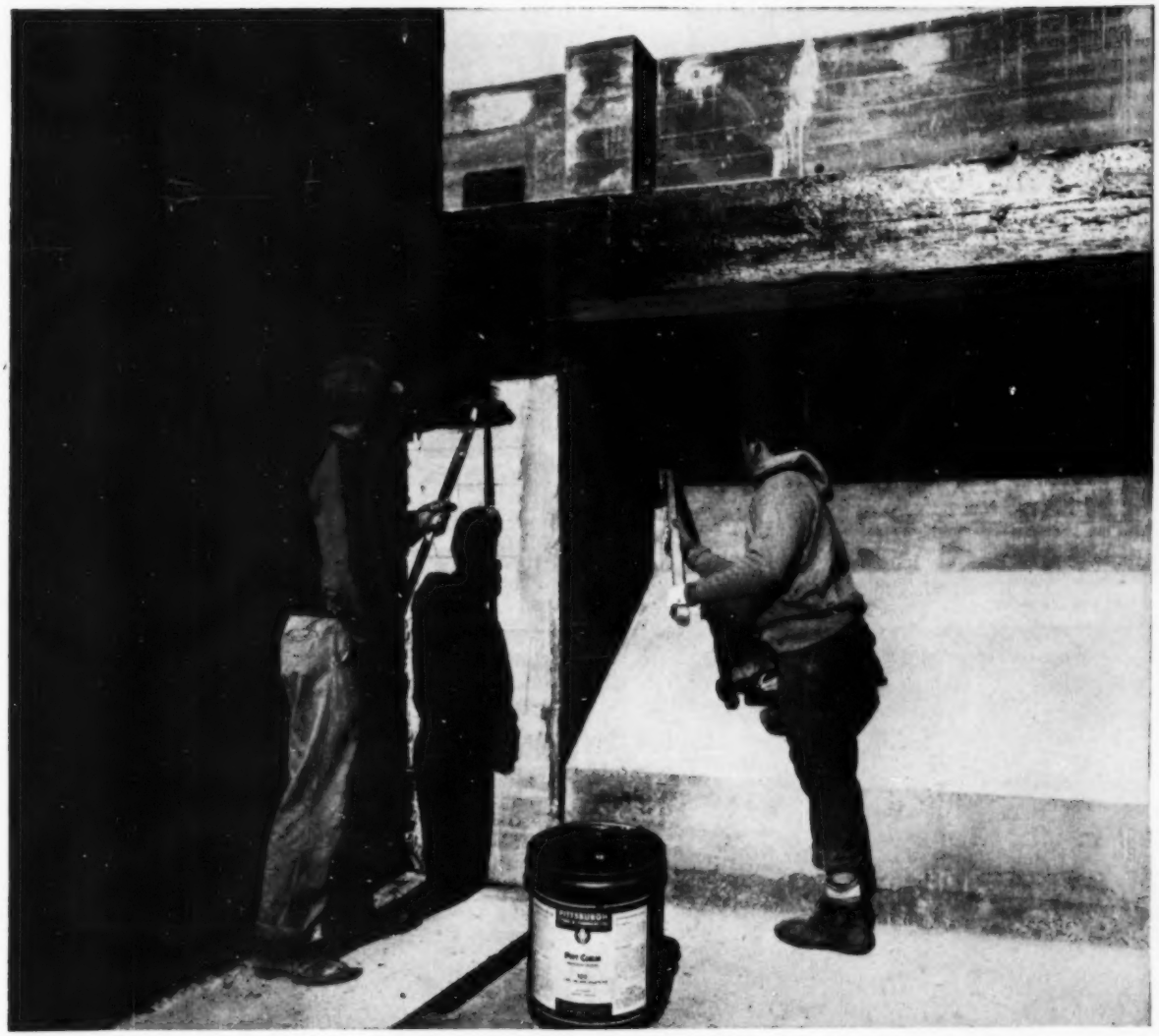
Direct drive . . . belt or geared drive . . . electric drive . . . F-M 2-cycle engines provide the flexibility to keep the pressure up under all extremes of operating conditions. And—produce important savings in maintenance, operation and total cost per gallon pumped.

Write today for the engineering assistance of a Fairbanks-Morse municipal power specialist to help you select the right power and the right pump to fill your needs. Write to Fairbanks, Morse & Co., Chicago 5, Illinois.

FAIRBANKS-MORSE

a name worth remembering when you want the best

DIESEL AND DUAL FUEL ENGINES
DIESEL LOCOMOTIVES • RAIL CARS
ELECTRICAL MACHINERY • PUMPS
SCALES • HOME WATER SERVICE
EQUIPMENT • FARM MACHINERY
MAGNETOS



Sewage Corrosion will never eat away this settling tank!

This sewage settling tank is being coated with one of the most durable of all protective materials—Pitt Chem Tar Base Coating. And with good reason. For it will soon be handling highly corrosive sewage that often eats through ordinary paints and protective coatings.

Pitt Chem Tar Base Coatings are up to 10 times as thick as ordinary paints. They're easy to apply to metal, concrete or masonry surfaces, and their cost is nominal compared with the investment they protect. Leading sewage plant engineers acclaim them as the most satisfactory of all types of coatings for combatting sewage corrosion. *No other material does such a complete job of protection at so little cost.* ● We'll be glad to discuss *your* sewage corrosion problems.

W&D 4703

Write For FREE Corrosion Control Booklet

Tells where tar base coatings can save you money in your plant . . . what grades to use . . . how to apply them.

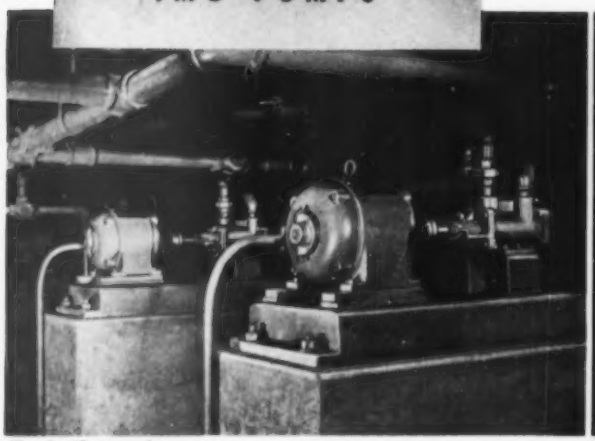
PROTECTIVE COATINGS DIVISION

PITTSBURGH COKE & CHEMICAL CO.

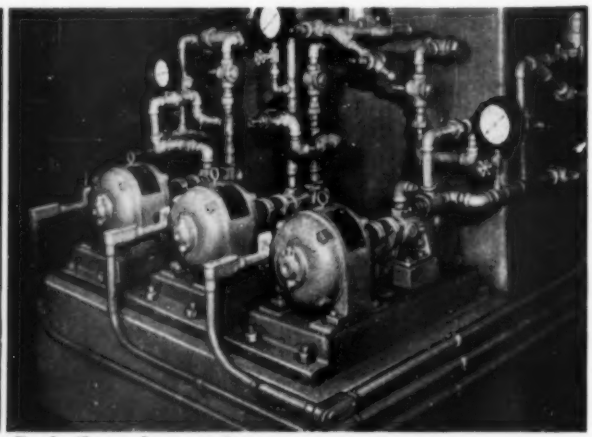
Grant Building • Pittsburgh 19, Pa.

COAL CHEMICALS • AGRICULTURAL CHEMICALS • FINE CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

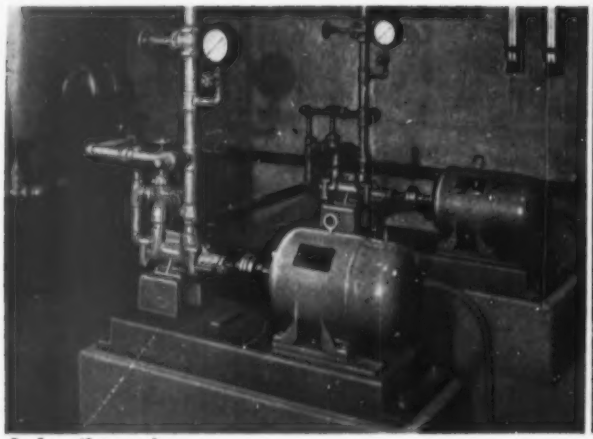
DE LAVAL IMO PUMPS *hold down 4 jobs at Owl's Head*



Fuel oil transfer



Fuel oil supply to engines



Lube oil transfer

Lube oil circulating

Again De Laval IMO rotary pumps prove their versatility. Eighteen of them are handling all the fuel and lube oil services for the six National Supply Company dual-fuel engines in the new Owl's Head sewage treatment plant in Brooklyn, New York.

The unique IMO design—*with only three moving parts*—assures long, trouble-free performance. IMO pumps are quiet, pulsation-free, compact and excellent for direct-connected high-speed operation.

Whether your power source is dual-fuel, gas or diesel engine, or oil-fired steam, be sure to specify IMO pumps for your next oil handling job. Use them in high and low pressure fuel oil burner sets, pumping fuel oil to burners, unloading and transferring fuel and diesel oil, handling oil for lighting off service and providing pressure lubrication on pumps and turbines. Send for Bulletin LG showing complete IMO line for capacities to 1,000 gpm at pressures to 500 psi and for capacities to 150 gpm at pressures to 1,500 psi.

DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY
824 Nottingham Way, Trenton 2, New Jersey

DL 187

500,000-gallon Horton elevated tank built for the Wayne County Road Commission on the outskirts of Detroit, Michigan.

HORTON

RADIAL-CONE BOTTOM ELEVATED WATER TANKS

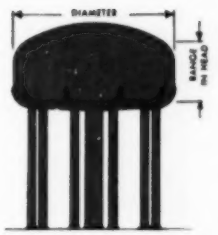
Horton* radial-cone bottom elevated water tanks provide an economical means of meeting peak loads in water systems, especially when there are wide variations between minimum and maximum rates of use. With a radial-cone bottom tank, the system can be designed to take care of average needs and the reserve in the tank used to provide the additional water needed during peak periods.

The water in the tank flows into the system by the force of gravity alone. The head provided by the tank will maintain a uniform pressure in the mains during periods when pumps are shut down or are temporarily out of service due to power failures, mechanical difficulty or other emergencies.

Horton elevated water tanks of radial-cone design are built in standard capacities from 500,000 to 3,000,000 gallons. In smaller capacities, we build ellipsoidal-bottom tanks from 15,000 to 500,000 gallons. Write our nearest office for estimates or quotations on a Horton tank to meet your needs.

**Trademark Registered in U. S. Patent Office*

Horton Radial-Cone Bottom Elevated Tanks



Capacity in U.S. Gallons	Diameter of Tank	Range of Head	Capacity in U.S. Gallons	Diameter of Tank	Range of Head
500,000	60′ 4″	25′	1,500,000	96′ 0″	30′
750,000	74′ 3″	25′	1,500,000	88′ 0″	35′
750,000	67′ 6″	30′	2,000,000	102′ 0″	35′
1,000,000	86′ 0″	25′	2,000,000	112′ 0″	30′
1,000,000	78′ 0″	30′	2,500,000	114′ 0″	35′
1,000,000	71′ 6″	35′	3,000,000	117′ 0″	40′
1,500,000	104′ 0″	25′			

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WATER & SEWAGE WORKS

Safety in Sewage Works Maintenance and Operation

The Sixth of a Series

by **LEROY W. VAN KLEECK**, *Prin. San. Engr., Conn. State Dept. of Health Hartford, Conn.*

This series began is our July issue. The first five installments covered Part I (Employee Safety in Sewers) and Part II (Employee Safety in Sewage Booster Pumping Stations).

Part III of the series, starting in this issue, is devoted to safety measures specifically for sewage treatment plants. However, many of the recommendations made in earlier installments apply with equal force to the present discussion and can be reviewed with benefit.

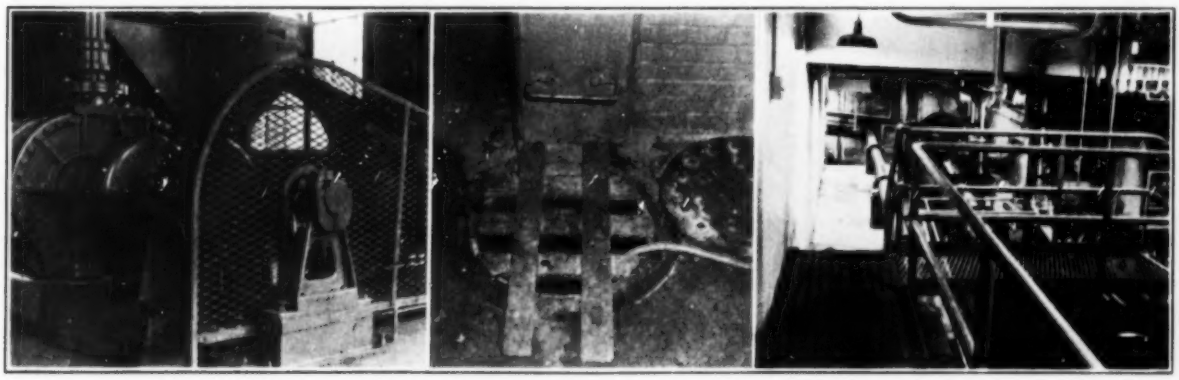
Fig. 1—SIGNS to warn of danger should be conspicuous
The sign above bars entrance to an icy walkway.

Part III
Employee Safety in Sewage Treatment Plants
Section A
Prevention of Physical Injuries

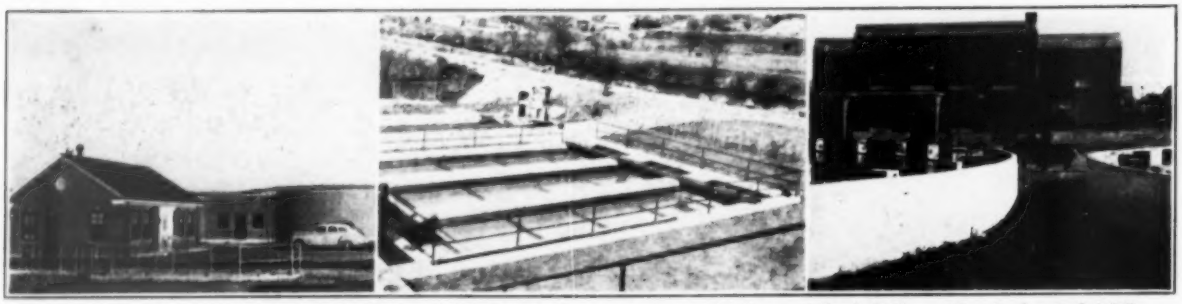
THE prevention of physical injuries in sewage treatment plants follows—with some elaboration—the precautions already given which apply to pumping stations.

The major considerations are:

1. Erect warnings at danger spots. Such warnings include judiciously placed signs and the use of red paint on projecting objects (Fig. 1).
2. Provide metal guards (Fig. 2) for moving parts of machinery.
3. Keep manhole covers in place or provide guards (Fig. 3).
4. Erect fencing or guard rails around settling tanks or at other locations where operators might fall (Fig. 4, 5, 6 and 7). Life preservers



PLACE guards at danger spots. Fig. 2—(left) Metal guards should cover moving parts of machinery. Fig. 3—(center) Manhole covers should be kept in place or temporary guards should be provided. Fig.4—(right) Fencing or guard rails should protect elevated walkways.



OUTDOOR protection of danger spots. Fig. 5—(left) Guard railing around grit chamber and Parshall Flume. Fig. 6—(center) Walkway around settling tanks protected by guard railing. Fig. 7—(right) High side walls of circular settling tank prevent falls.

attached to ropes and fastened to settling tank guard rails may also save a man from drowning.

5. Use enclosed switchboards and place rubber mats in front of them.

6. Open the main control switch and tag it, when working on a motor or other electrical equipment.

7. Use ample natural or artificial lighting in work areas (Fig. 8, 9 and 10).

8. Be careful when using vertical ladders or steep, narrow stairs. Remember that *falls are the second largest source of compensation injuries.*

9. Employ good housekeeping. Keep tools and portable equipment in designated places. Maintain walks, stair treads and ladder rungs free of grease, oil or ice. Remove debris from working areas.

10. Teach employees to lift objects with the aid of the leg muscles to reduce back injuries and ruptures. Remember that the *handling of objects constitutes the major source of compensation injuries.*

11. Equip the plant with the adequate number of fire extinguishers. In addition to the carbon tetrachloride or carbon dioxide types, provide one or more of the soda ash and acid type of extinguishers.

12. See that all chief operators and foremen have first-aid training in treating physical injuries.

13. Post prominently the phone numbers of several physicians, the nearest hospital, fire station, and ambulance service, and the police station.

14. Stage fire and emergency first-aid drills at large plants.

15. When carrying out a major operation or making major repairs to equipment see that adequate help *under proper supervision* is available. Use the proper tools and avoid hurrying. Use hoists or power trucks to lift heavy objects.

Section B

Prevention of Body Infections

In addition to the precautions given in Parts I and II, the following preventive measures should be taken at sewage treatment plants:

1. Provide *hot* water of potable quality for washing, and cold water of similar quality for drinking.

2. Have dressing room facilities for a change of clothing. Shower stalls should be included. Even the smallest plant should be provided with locker space for a change of clothing.

3. A lunch room is desirable at the larger plants. Facilities for making coffee and a refrigerator for cold drinks and perishable foods are more than refinements—they pay off in employee morale and health (Fig. 11).

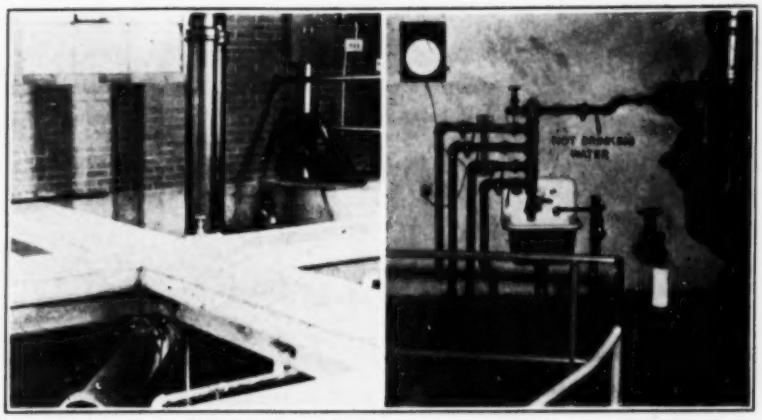
4. Install swing doors and foot valves for running water in dressing rooms, lunch rooms and laboratories. These safety facilities prevent contamination of door knobs and water faucets.

5. Avoid *all* cross-connections between the potable water supply and piping or structures containing sewage, sludge or other filth. In addition to those mentioned under pumping stations the following cross-connections often exist at sewage treatment plants: Flushing connections of all types, make-up water for digestion tank heating coils or heat exchangers, digester scum spraying nozzles, and vacuum filter shower pipes installed below the rim of the filter vats. Constant vigilance is necessary to avoid such connections (Fig. 12).

Cross-connections of even a temporary nature should not be allowed (and may be prohibited in any event by state or local regulations) because of possible negligence in immediately breaking such connections. Cross-connections may be avoided by use of a segregated pumped supply. Water for flushing, hosing and chlorinator ejector use is supplied at many plants by the use of pumped effluent water (Fig. 13).

LIGHTING in work area should be ample. Fig. 8—(left) Combination of daylight and artificial light provides well lighted plant interior. Fig. 9—(center) A bright and spacious motor room. Fig. 10—(right) Good illumination in a plant basement.

Fig. 11—LUNCHROOM in a modern plant. Note cabinet space, sink, and electric grill. This room also provides a refrigerator and dining table.



Figs. 12 and 13—CROSS-CONNECTIONS must be prevented—even those of temporary nature.

Note (left) hose connected to potable water supply is coiled safely above sludge tank. Effluent sewage may be used (right) for flushing; here a conspicuous sign says, "Not Drinking Water."

6. Insist on the use of rubber gloves when cleaning sludge pumps or performing other plant duties requiring intimate contact of the operator with sewage or sludge.

7. Periodically give all employees inoculations for typhoid.

Section C

Prevention of Dangers from Noxious Gases or Vapors and Oxygen Deficiency

Covered Pits or Tanks

Any tightly covered pit or tank regardless of depth, at a sewage treatment plant, should be suspected of noxious gases or oxygen deficiency. It should not be entered until thoroughly ventilated and until tests show the atmosphere to be safe for work. Workmen have been overcome in valve pits as shallow as 5 feet as a result of noxious gas seepage or oxygen deficiency.

An earth-bottom structure is particularly dangerous because of the possibility of oxygen deficiency resulting from the decomposition of organic matter in the soil, replacing the available oxygen with carbon dioxide gas. *Remember, no tightly covered structure is safe until tests prove it so.*

Screening, Detriting and Comminuting Facilities in Enclosed Areas

These facilities, constituting the first stage of sewage treatment, are subject to the accumulation of any gases which may be discharged through the open inlet sewer. All sources of ignition should be prevented, including a ban on open lights and smoking. Explosion-proof lighting fixtures, motors and other electrical equipment should be used.

Adequate provisions for ventilation are essential. Such ventilation may be accomplished in structures at ground level through use of open windows or door louvres; underground structures should be provided with fresh air intakes near the ceiling and mechanical exhaust ducts near the floor.

Digested-Sludge Pumps Located in Confined Areas Below Grade

During 1943, three men lost their lives as a result of oxygen deficiency in a digested sludge pumping basement at an industrial plant near Point Pleasant, West Va. These deaths were the result of permitting digested sludge to accumulate on the floor through an open valve on the sludge pump while the pump was being cleaned. Obviously the methane and carbon dioxide in the gas released by the sludge displaced the oxygen in the atmosphere and caused the deaths.

Fig. 14—BLOWER provides positive ventilation. The above suction fan and duct system ventilates a valve chamber and basement, exhausting air to roof of building.

The flow of digested sludge onto the floor of confined areas should be prevented by tightly shutting off the flow of sludge with the control valves. Valves not readily accessible should be made easily accessible by use of wheel chains. In addition, positive means for forced ventilation should be provided as outlined above for basement screening, retriting and comminuting structures (Fig. 14).

Open Digested Sludge Storage Tanks Located in Enclosures

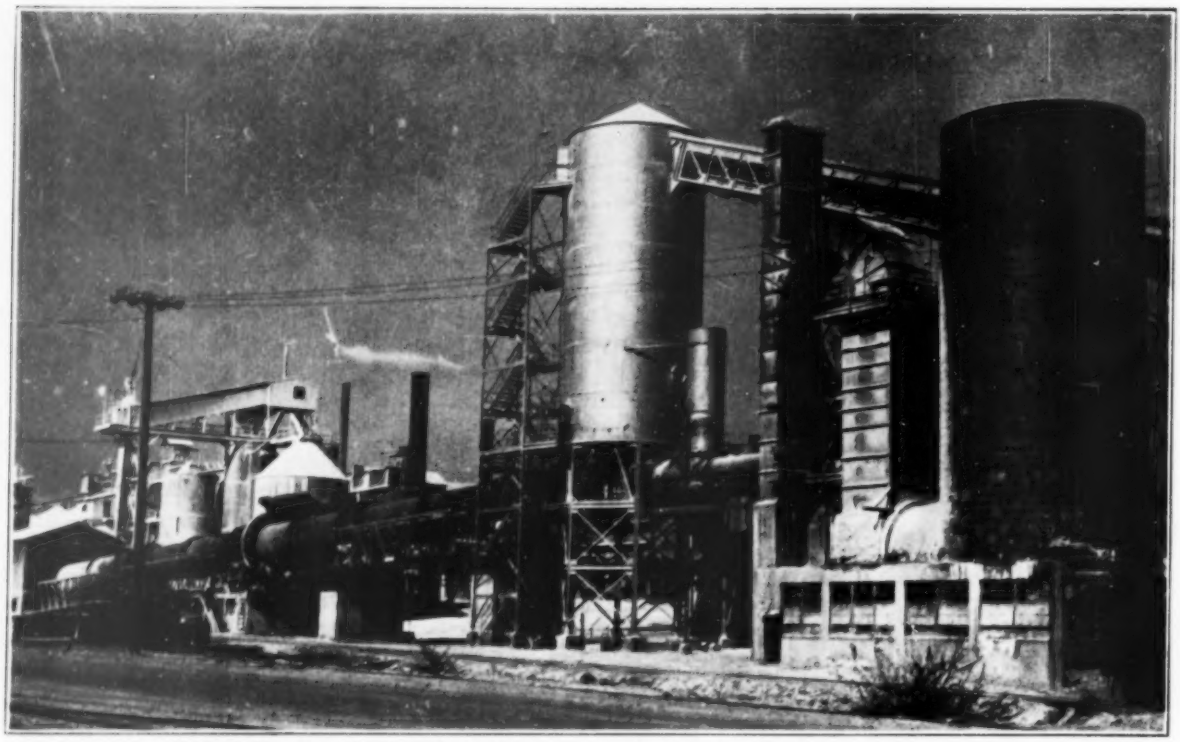
Such tanks are sometimes built for digested sludge storage ahead of vacuum filter conditioning tanks, for batch-mix treatment of sludge prior to vacuum filtration or for elutriation of sludge.

Totally enclosed tanks should be vented at the top to atmosphere.

Open tanks, especially those in subbasements, require that the structure housing them receive thorough ventilation by means of fresh-air intakes and mechanical exhaust ducts. Explosion-proof electrical fixtures may be desirable in such cases, and a ban on open lights and smoking should be enforced.

The next installment will be the concluding article in this series

THRIFT is that habit of character that prompts man to work for what he gets; to earn whatever is paid him; to spend wisely; to save, but not to hoard.



MODERN rotary kiln lime plant. Calcination can be designed to produce a specific product.

How to Buy and Use Lime as a Neutralizing Agent

Price, Reactivity and Basicity Determine the Suitability of Lime for this Use

by RICHARD D. HOAK, *Senior Fellow, Mellon Institute, Pittsburgh, Pa.*

IT is probable that *for neutralizing acidity* lime is used more extensively than all other substances. Over a long period of time, lime has found many applications as a neutralizing agent, because of its relative cheapness and general availability. But in spite of long experience with it, a number of misconceptions still persist about the chemical properties of lime and the technology of using it efficiently.

Among some users, the word "lime" signifies a fairly definite article of commerce. This leads to the belief that all limes are much the same, regardless of their source. Lime manufacturers are fully aware that this is not so. Each endeavors to make products of consistently uniform quality, to guarantee that month-to-month variations in the chemical and physical properties of their particular merchandise will be small. But the great variation in composition and structure of limestones from different quarries, and the variations of calcination practice, yield limes whose properties differ widely.

Several Types of Lime

All limestone quarried for conversion to lime contains small to moderate amounts of impurities, of which silica, iron oxide, and alumina are the most common.

Fig. 1 illustrates spectrogphically the variety of impurities that may occur in commercial limes. Samples 1 and 2 are commercial high-calcium and dolomite limes, 3 and 4 are U.S.P. lime and magnesia, respectively. Note that the boron in the U.S.P. magnesia sample shows that it was recovered from sea water.

In addition to impurities, limestone may contain magnesium carbonate in amounts from almost zero to equimolar proportion with its calcium carbonate. Stone containing less than 10 per cent magesium carbonate is considered to be high-calcium limestone; if more than 10 percent is present, it is called magnesian limestone.

Dolomite is a definite mineral consisting of a crystalline matrix of the double carbonate of calcium and magnesium. In some limestones the two carbonates are intimately intermingled in approximately equimolar proportions, but not crystallized as a double salt; such stones also are usually called dolomite. Where magnesium carbonate is present in substantially greater proportion than calcium carbonate, the stone is termed dolomitic magnesite. With such a variety of raw materials it is obvious that limes can be made with properties that vary over a considerable range.

Neutralization Economy: Three Important Factors

Delivered price, available basicity, and reactivity are factors of fundamental importance for economy in neutralization. The low cost of lime may suggest that savings resulting from careful attention to efficiency in neutralization practice would be insignificant. There are many plants at which upwards of $100,000 is spent annually for lime to neutralize acidic waste waters. Thoughtful analysis of the neutralization problem, both in plant design and operation, can readily yield appreciable savings, even where modest operating costs are involved.

Price

Where industrial wastes are to be neutralized, it is axiomatic that the cheapest agent capable of fulfilling the requirements should be used. But delivered cost per ton is not usually a sound criterion of the actual cost of available basicity. Limes selling for the same price can have quite different chemical properties. Buying a product at a premium price often results in net gain through economy in operation. Where purchases are made direct from the manufacturer, a user can generally be sure of getting a product of dependable uniformity. Purchase from a jobber can be risky, however, unless a definite brand is specified. In any case, wherever possible, even cheap neutralizing agents should be held to specifications by routine analysis.

Available Basicity

Where lime is bought to neutralize acidity, the purchaser is really paying for available basicity. The same price is paid for the inert material in lime as for the reactive fraction. Actually, the inert material costs more, since it increases the final sludge volume without contributing to the reaction, and thus adds to the expense of sludge removal. The cost per unit of basicity must be used, therefore, if the prices of different neutralizing agents are to be compared fairly.

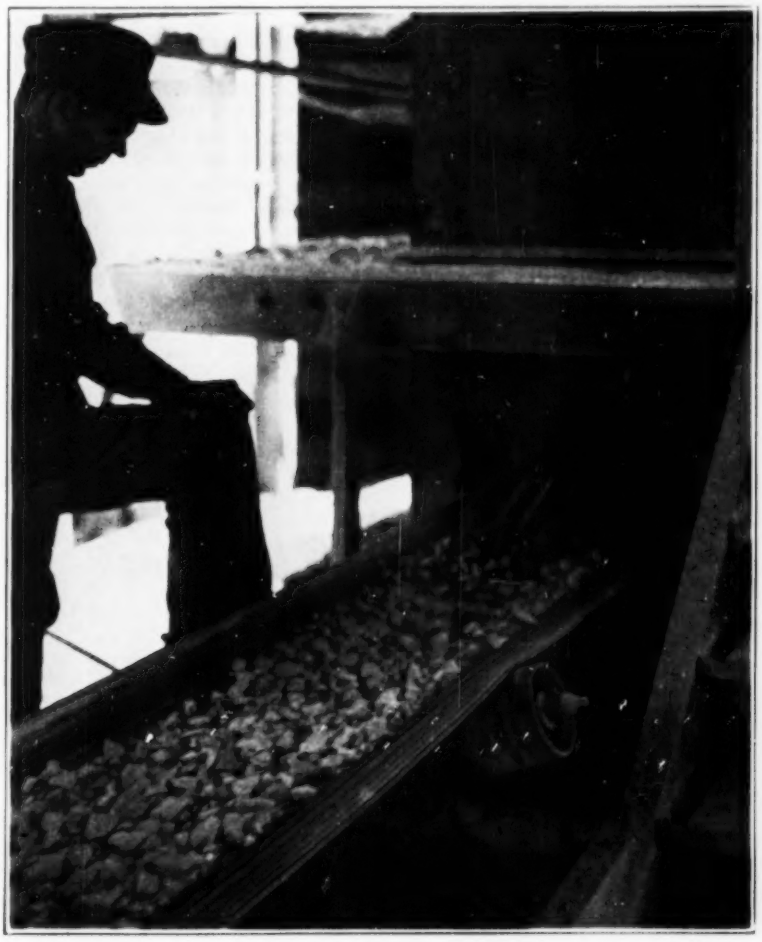
Chemical analysis of lime is time-consuming, and it cannot be depended upon to provide an accurate measure of available basicity. This results from the fact that some of the calcium and magnesium oxides may combine with silica, iron oxide and alumina during calcination to form compositions that are insoluble in acids. Routine chemical analysis determines total calcium and magnesium without revealing how they are combined with other elements. Where the original stone contains an appreciable proportion of inerts, the potential basicity of the lime may be reduced considerably, especially if overburning has been severe. Also, the reactivity of lime decreases with the degree of overburn, and neutralizing power is thereby lost.

The only sound way to determine available basicity is to measure it under conditions simulating those of actual use. Such a determination can be made easily and quickly in the laboratory. A moderate excess of a representative sample of the acidic liquor, at the temperature to be expected in practice, is mixed with a known amount of neutralizing agent for a definite time. The excess acid is titrated, and available basicity calculated, as grams of equivalent calcium oxide (CaO) per gram of sample, for the time and temperature of the determination. If the agent is quicklime it must first be slaked; if hydrated lime it must be suspended in water. A series of determinations should be made at a number of uniformly longer time intervals. In some instances it may be desirable to run several series at different temperatures, to decide upon the best operating conditions.

This procedure can be quite useful for attaining maximum neutralization efficiency. By adopting a set of standard conditions (acid volume and concentration, weight of sample, temperature, and mixing time) it provides a rapid method for checking the quality of each shipment of neutralizing agent; but care must be used in preparing a sample that is truly representative of the shipment. It can be used to determine whether the proper amount of agent is being applied in existing plants; and, if so, whether the correct mixing time is being provided for maximum utilization of basicity. It is especially useful in designing a new plant because it provides a rational method for estimating capacities. Finally, it permits holding to a minimum the excess of agent that is customarily added as a safety factor.

Reactivity

The composition and structure of limestones, plus calcination practice,



BULK pebble quicklime on a conveyor belt after calcination in lime kiln

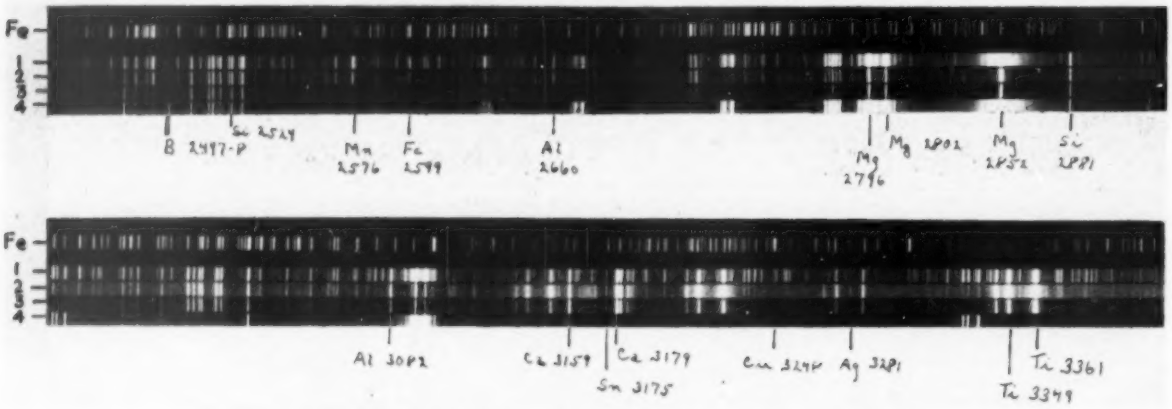


Fig. 1—SPECTROGRAPHIC record of impurities in comercial lime samples

Bands 1 and 2 are those of high-calcium and dolomitic lines, 3 and 4 and U.S.P. lime and magnesia, respectively Presence of boron (double lines) in band 4 indicates the lime was recovered from sea water.

conspire to yield limes with a wide range of reactivity. Highly reactive limes are usually essential for optimum neutralization efficiency. Reactivity rarely has any influence on the price of lime, but it has a direct bearing on the capital and operating costs of a neutralization plant. The more reactive the lime the smaller the plant need be to treat a given volume of acidic liquor—and the lower the operating cost. Under our present tax laws, the capital cost of a treatment plant is very important because it must be added to the plant investment of the producing company; it cannot be charged against profits as an operating expense.

Reactivity cannot be measured by ordinary chemical or physical analysis. It can be estimated roughly by observing the settling rate of a lime suspension. Normally, lime suspensions that settle slowest are the most reactive. Reactivity can, however, be determined accurately by the procedure for available basicity. A series of determinations, in which three of the variables are held constant while the fourth is varied, will give precise information on reactivity. Mixing time is the variable that would ordinarily be studied, because the other three are often fixed by local conditions. Actual operating practice should always be simulated as closely as possible.

Influence of Calcination Practice on Reactivity

Lime and magnesia must dissolve before they can react with an acid. Both react with water and go into solution as hydroxides. Calcium hydroxide is slightly soluble (1.7 g/l), and magnesium hydroxide is rather insoluble (0.01 g/l). There substances are therefore used as aqueous suspensions in neutralization processes. The rate at which they can react with an acidic liquor is governed directly by their rates of solution. This rate is controlled primarily by the concentration of the substance in the surrounding water, and the exposed surface of the solid material.

Particle Size and Solubility Rate

Where the hydroxides are reacting as rapidly as they dissolve, there is a driving force which promotes solution from the solid phase. But the rate at which solution can occur is proportional to the area of the solid. Thus, the smaller the particles, the more rapidly they will dissolve. This is why the most reactive limes are those that yield the finest particles when they are hydrated. Certain dissolved substances increase the solubility of lime and magnesia in water, and some decrease it. This must always be remembered when the reactivity of a lime is compared in different solutions.

Among the several factors responsible for the reactivity of a lime, calcination practice is the most important. This is so because calcination technology can be designed, within limits, to fit the requirements of a particular stone or product. When limestone is calcined, its carbonate decomposes and the carbon dioxide escapes. In this process the stone does not disintegrate, but retains its original crystalline structure. The resultant lime should therefore have a very porous and fine-grained structure.

Porosity is Determined by Lime Density

The true density of lime varies but little, whereas its apparent density can be widely variable. Porosity, which is a significant factor in reactivity, is the ratio of apparent density to true density. Apparent density, in turn, is governed partly by the manner in which the stone has been calcined. A fairly pure high-calcium stone, if properly calcined, can yield a lime having more than 50 per cent pore space.

Although the melting point of pure calcium oxide is very high (about 4650°F), it begins to soften at a comparatively low temperature. For this reason, the initial fine-grained structure of lime may change rapidly on continued exposure to heat. As a result, the surface area of the lime may be reduced considerably. It should be noted that brief exposure to a very high temperature may have the same result as long exposure to a relatively moderate temperature.

The impurities in lime tend to increase reduction in surface area by lowering the temperature at which softening occurs. In addition, these impurities combine with calcium and magnesium oxides at high temperature to form compounds or solid solutions which cause a portion of the lime to become wholly or partly inactive. Since the reactivity of lime is a function of both surface area and calcium oxide content, it is clear that calcination technology can exert a profound effect on this property.

Magnesian and Dolomitic Limestones

Most of the statements made about high-calcium limes apply equally to those containing substantial amounts of magnesia. Where limes contain more than about 10 per cent of magnesia, however, certain additional factors must be recognized.

When magnesian limestones are calcined, the burning must be carefully controlled to produce the desired type of product. Calcium carbonate dissociates at about 1650°F, and mag-

nesium carbonate at about 1380°F, at atmospheric pressure. This means that complete dissociation of the calcium carbonate fraction of a stone will result in some overburning of the magnesia that was formed first. In practice, the temperature differential between the two carbonates is probably lower than 270°F, because of the effect of factors that are not well understood.

Nevertheless, calcination of magnesian stone requires precise control of kiln operation to insure minimum overburn of the magnesia. Like lime, the reactivity of magnesia decreases with the degree of overburn. Since the low solubility of magnesia makes it normally less reactive than lime, overburning can easily change it to an inert component of the finished product.

Advantages and Disadvantages

Magnesian and dolomitic limes have two principal advantages over high-calcium lime. The lower combining weight of magnesium oxide permits it to neutralize about 1.4 times as much acid-equivalent as calcium oxide, and magnesium sulfate is about 150 times as soluble as calcium sulfate. Both of these properties are economically important. High-calcium and magnesian limes usually sell for the same f.o.b. price. Freight rates being equal, a purchaser therefore pays less per unit of basicity, in proportion to its magnesia content, when he buys magnesian lime. The relatively high solubility of magnesium sulfate can keep sludge volume to a minimum, and thereby reduce the cost of sludge disposal.

These desirable properties are counterbalanced by several disadvantages. Obviously, nothing will be gained, and a great deal may be lost, by using overburned magnesian lime. But even reactive magnesian limes have peculiar properties that detract from their usefulness. The magnesia fraction of a lime is most reactive in strongly acid solutions; its reactivity decreases as the pH of the solution rises, and, at high pH values, it does not react at all. This property indicates that dolomitic lime can be used most advantageously in applications where complete neutralization is not required, because its reactivity declines rapidly at pH values above 6.

By incorporating special features in the design of a neutralization plant, however, dolomitic lime can be used effectively at pH 9 or somewhat higher. Fig. 2 illustrates laboratory equipment used to determine the rate of reaction of dolomitic lime.

Practical Applications

Two examples may serve to illustrate the peculiarities of neutralization with dolomitic lime. The spent liquor from pickling steel with sulfuric acid is commonly neutralized with lime, and this process has been studied in detail, both in the laboratory and in the field. Properly slaked high-calcium lime rapidly neutralizes the acid and precipitates the iron in pickle liquor. This is a simple operation, requiring only that the proper amount of milk of lime be thoroughly mixed with the spent liquor.

When a milk of dolomitic lime is used under the same conditions, completion of the reaction takes five hours or more, instead of 15 to 20 minutes. This results directly from the relatively low reactivity of the magnesian fraction of the lime.

When the two reactants are mixed, the lime fraction reacts promptly with the free acid and ferrous sulfate. This raises the pH of the solution, thereby decreasing the reactivity of the magnesia. As the neutralization approaches completion, therefore, the reaction becomes progressively slower because of a diminishing driving force for solution of magnesium hydroxide.

Finally, the neutralization is completed by the least reactive portion of the magnesia fraction. But this takes a long time, and the size of the neutralization plant must be large in proportion. If the rate of the neutralization reaction could be increased, advantage could be taken of the lower cost of basicity of dolomitic lime.

Factors Affecting the Reaction Rate

When ferrous hydrate oxidizes, it releases hydrogen ions; this lowers the pH of the solution and increases the reaction rate. Oxidation of ferrous iron can be promoted by exposing it to air. This can be done easily by direct aeration or by using an agitator that inducts air, such as a Turbo-Mixer. Increasing the temperature

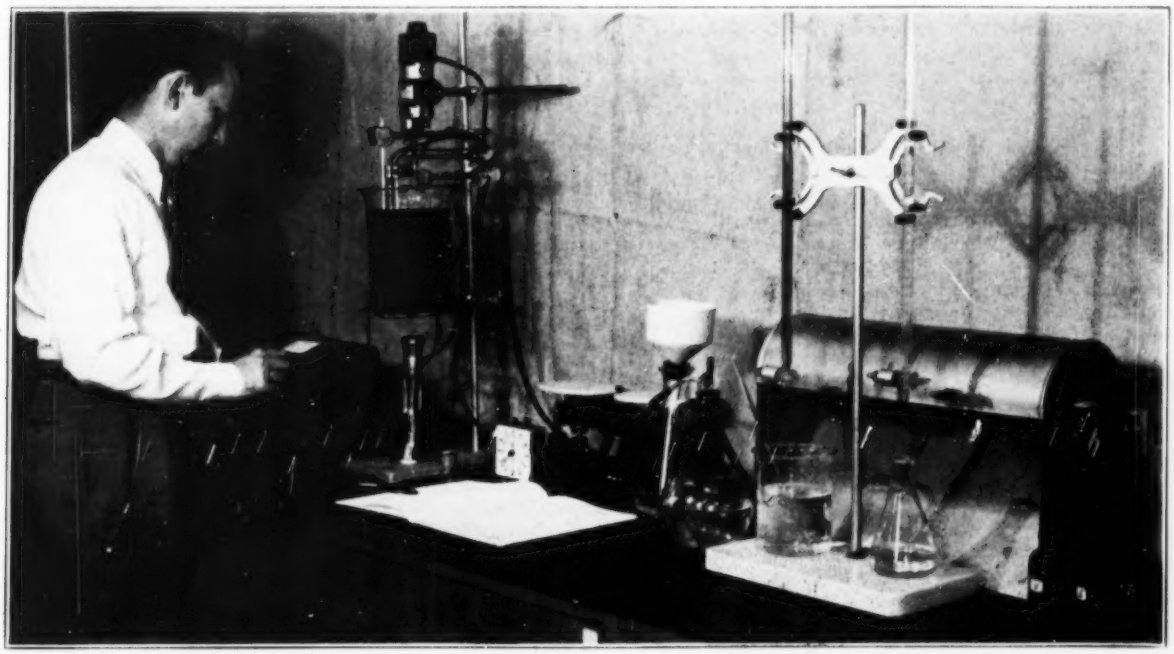


Fig. 2—LABORATORY equipment used to determine rate of reaction of dolomitic lime

also increases the reaction rate, as does the addition of a small excess of lime.

It has been found that by provision of adequate aeration, by operation at 170°F or higher, and by using a five per cent excess of lime, pickle liquor can be neutralized in less than an hour with reactive dolomitic limes that otherwise would require five hours. Adoption of these measures should permit neutralization of pickle liquor at a cost no greater, and possibly less, than for high-calcium lime.

In another instance, a large enough excess of dolomitic lime was added to an acidic waste to raise the pH to 6.5 in about two minutes. In this case only the lime fraction reacted, and all of the magnesium oxide component was found in the sludge. When the reaction time was increased, the amount of lime added could be reduced and still develop a pH of 6.5; at the same time, the magnesia reacted completely. This experience illustrates the fact that where reaction rates are increased by adding a large excess of dolomitic lime, the magnesia component is not only wasted, but it needlessly increases the sludge volume.

Where dolomitic lime is used to develop a high pH, it is important to recognize that magnesium hydroxide is insoluble at pH 10.5 and above. If it is desired to raise the pH of a solution above 10.5 with dolomitic lime, the lime fraction will first have to precipitate all the magnesium salts in solution. At pH 10.5 all magnesium will have been precipitated as the hydroxide; above this point only the lime fraction will be effective in raising the pH further.

Improper Slaking Causes Diminished Reactivity

The effect of slaking on reactivity is not always fully appreciated. Both lime and magnesia must be converted to hydroxides before they can go into solution and react with acidic substances. The rate of hydration depends partly upon the composition of lime and the way it has been made, and partly upon slaking technique. Where lime is intended for chemical uses, improper slaking can reduce its reactivity seriously.

In general, the more rapidly a lime can be hydrated completely, the finer will be the resultant particles. This can best be accomplished by slaking with that volume of water, preferably warm, which will develop the highest practical slaking temperature. Too much water results in drowning the lime, too little in burning it; both amounts reduce its potential reactivity.

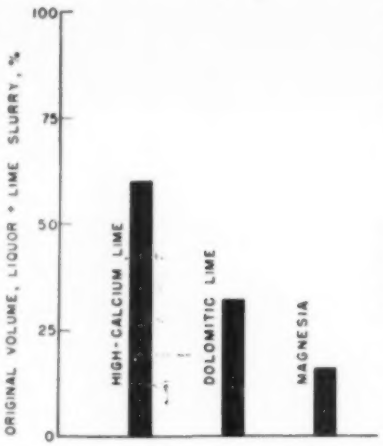


Fig. 3—SLUDGE from neutralized pickle liquor

The minimum volume resulting from three types of lime, using procedure described by the author.

The rate of hydration of different limes varies so much that the proper amount of water to use must be determined by trial; usually, about four pounds of water per pound of dry lime will yield a reactive slurry.

Magnesium oxide hydrates much more slowly than calcium oxide. Where magnesian or dolomitic limes are used for neutralization, it is desirable to allow the heavy suspension to age for several days before dilution to a milk suitable for use in neutralization equipment.

Dry-hydrated limes often are used for neutralization at small installations. In such instances, the higher cost of basicity is overweighed by convenience in handling. A freshly slaked lime, however, will be more reactive than the same lime that has been dry-hydrated.

Sludge Volume

Disposal of the sludge resulting from lime neutralization can be quite costly. Where land is available, the sludge may be lagooned. But lagoons are unsightly, and they always seem to fill up faster than anticipated. If sludge must be hauled to a dump, the expense can be burdensome.

Sludge frequently is unavoidable as a by-product of lime neutralization. Measures that can be taken to hold sludge to a practical minimum will nearly always be economically sound. Some limes produce a larger sludge volume than others. The lime that produces the least sludge, without an undue sacrifice of reactivity, should always be used. In conventional plants neutralizing sulfate liquors, dolomitic limes generally produce a larger sludge volume than high-calcium limes of equivalent quality. This often has been a source of misunderstanding. Although magnesium sulfate is quite soluble, dolomitic limes tend to make a fluffy, bulky sludge with a lower dry solids content than their high-calcium counterparts.

Neutralization Techniques

Lime neutralization seems to be a very simple operation. It appears that the desired result can be attained easily, just by mixing the proper amount of lime slurry with the acidic liquor. Many operators believe that nothing else is worth bothering about, and some of these do not even provide satisfactory agitation. Where the several factors important to lime neutralization have been taken into account, potential gains can readily be cancelled by poor mixing. Apparently it is not obvious that thorough agitation is essential for complete utilization of basicity. Efficient mixing is particularly important where salts of heavy metals are present in the acidic liquor.

Fortunately, a technique has been developed which permits full use of the basicity of any lime, and, at the same time, produces a minimum sludge volume. Developed primarily to reduce the cost of pickle liquor neutralization, the procedure can be adapted to many other problems.

Simple Process in Commercial Use

Operation of the process comprises feeding streams of pickle liquor and milk of lime in stoichiometric proportion to an agitator-aerator held at 170°F or above, and continuously filtering the resultant slurry. The aeration is controlled to maintain a ferric/ferrous ratio of 2.5 to 3.5 in the mixture; this yields a precipitate that settles and filters very rapidly.

Aeration should be provided by a mechanical device for dispersing air, such as a Turbo-Mixes; porous diffusers or bubbling devices do not disperse the air adequately for rapid oxidation.

If the liquor is treated hot, as it comes from the picklers, no supplemental heat is required, but it is important that the temperature of the mixture be at least 170°F.

The process forms a slurry with high-calcium lime that can be dewatered on a vacuum filter at a rate of 400 pounds of cake per square foot per hour, and the cake will contain 60 per cent dry solids. The slurry from dolomitic lime does not filter quite as rapidly, but the process permits full utilization of the basicity-advantage of this material.

The process is simple to operate, and it has been in commercial use for several years. The final sludge volumes for pickle liquor neutralized by this process are shown graphically in Fig. 3.

A Dry-Lime Process is Convenient but Costly

Where the volume of acidic liquor does not exceed a few thousand gallons per day, the dry-lime process developed by C. J. Lewis can sometimes be used to advantage. The liquor is treated with a considerable excess of dry hydrated lime and allowed to settle. The excess lime creates a granular sludge that dewaters readily on a rotary vacuum filter.

At a commercial installation, the filter cake is discharged directly to a truck, which hauls it to a dump. Convenience of operation justifies the substantial excess of lime required by the process; it would be too costly for large installations.

Research Pays Dividends

In these days of widespread industrial research it is unnecessary to stress the fact that such activities have been immensely profitable. It would be incorrect to assume that the monetary gain of the sponsors of research is the sole benefit it confers. Research is responsible, more than anything else, for the steady improvement in our standard of living. Basically, research is a persistent seeking for facts that will increase our understanding of the environment in which we find ourselves. In its synthetic aspect, research combines seemingly unrelated facts and thus evolves new ideas, new products, and new industries. Research is autocatalytic, because it is catalyzed by its own products.

Lime is very likely the oldest chemical used by mankind. It has been made and used for such a long time that it is almost taken for granted. The fact that it is venerable may cause some of us to think we know all about it, and that research would be a waste of time and money. That this is far from the truth is illustrated by the advances that have been made in neutralization technology in recent years.

Always More Needs for Neutralization

Basic data on the economics and technology of neutralization with limes and limestones were developed by the Fellowship of the American Iron and Steel Institute at Mellon Institute. This work was undertaken to supply the steel industry with dependable data not otherwise available. Some individual lime companies apparently were stimulated by this research to embark on pilot studies which resulted in highly useful information. But much investigational work still remains to be done.

The increasingly rapid progress that is being made in the field of stream pollution abatement affords good evidence that more and more acidic wastes will require neutralization. This is an expensive operation. It is costly not only by reason of the neutralizing agent that must be purchased, but because sludge disposal is vexatious problem. Nevertheless, the opinion has often been expressed that it is preferable to neutralize, instead of attempting to operate a complex recovery process that may only break even. Here is a real opportunity to provide industry with fundamental research data that will help solve a problem that is steadily becoming more troublesome.

Acknowledgment

This article is a contribution from the Multiple Industrial Fellowship that has been sustained at Mellon Institute since 1938 by the American Iron and Steel Institute. Credit is due to C. J. Lewis, who collaborated on much of the Fellowship research on neutralization. The techniques mentioned in this paper are described in detail in "Disposal of Spent Sulfate Pickling Solutions," published by the Ohio River Valley Water Sanitation Commission, Cincinnati 2, Ohio.

Robert S. Shaw Honored at Testimonial Dinner

In recognition of his recent appointment as Chief Public Health Engineer of the Division of Environmental Sanitation, New Jersey State Department of Health, and as a tribute to his record of public service, Robert S. Shaw was recently honored at a testimonial dinner.

Mr. Shaw was graduated from Princeton University with the degree of B.S. in Engineering in 1930, and received the degree of M.P.H. from Columbia University in 1950. He entered the State service in 1931 and has been promoted through the ranks from Assistant Sanitary Engineer to his present position.

Atlanta Experiences Its Worst Water Main Break

A Test of Public Relations That Stood

More than 3,000,000 gallons of purified water gushed from a break in a 36 inch force main leaving Atlanta's Hemphill Pumping Station, to make it the worst main break in the history of Atlanta's water works, according to Paul Weir, manager of the Water Department.

Pictures in *The Atlanta Journal* of Nov. 3 showed how trucks and automobiles were submerged on Northside Drive, an arterial highway underpassing the Southern Ry. tracks. Closing of this roadway caused the worst traffic jam in the history of the city. Homes were quickly without water and industrial plants were forced to shut down for lack of water supply.

Newspaper accounts of the crippling main break, rather than being condemnatory, were lauditory in praise of the rapidity with which the ruptured main was cut out of service and switch-over to other parallel mains was accomplished to gradually restore service, even if at subnormal pressures. The precision of the team work of supervisors and repair crews, working in relays throughout the night, was praised by reporters. These reports in turn brought forth editorials praising the efficiency of the water works personnel taking part in the unparalleled emergency and the quickness with which water service and fire protection was restored. One hundred crewmen worked feverishly for 15 hours to complete the repair of the main and restore full pressure service. Considering the magnitude of the break and its location such a performance struck reporters and others as being praiseworthy.

That, gentlemen, is public relations at its best. With first hand knowledge of the quality of foremanships and training of construction and maintenance crews on Atlanta's distribution system, we would expect nothing less than the accomplishments recorded—but, to have the press realize as much and publicly praise the water works personnel is something else. Hats off to manager Weir, to Atlanta's stalwart foremen, and to those indispensable colored men who work in mud and muck through the night that water may flow again.

Increasing Well Yields With Calgon Treatment

An Effective, Simple and Safe Method

by LOUIS R. CAPLAN, *District Representative, Parr Engineering Co. Washington, D.C.*

A CONSISTENT and economical supply of water is an essential to every municipality and industrial plant. Frequently new sources of supply must be developed to meet needs of expansion or relocation—and always realization of the full potential of the water supply is desired.

Water sources are varied but generally fall into the two classifications of surface supplies and ground or well water supplies. Here we wish to consider a means (1) of helping new wells to produce at the maximum output consistent with practical limitations of draw down and pump capacity, and (2) of rehabilitating old wells which have dropped off in productive capacity.

Depletion or limitation of the output of a well may be the result of mechanical failures—in which case appropriate repairs are, of course, indicated. More frequently, however, the loss or lack of capacity is caused by plugging of the screens or the water bearing strata around the well with minerals deposited from the water, with natural clays, silt, iron oxide or calcium carbonate, or by iron bacteria and slime forming organisms. To solve this problem a procedure has been developed for cleaning wells using the glassy phosphate, Calgon.

Properties of Calgon

Calgon is a phosphate glass produced by a thermal process from soda ash and food-grade phosphoric acid; it contains not less than 67 per cent P_2O_5. Calgon is essentially neutral having a pH of 6.7 to 7.0 in 1 per cent solution. It is generally used in water works practice in a form having the appearance of small flat platelets similar to broken window glass.

Calgon has many unusual properties which have led to its widespread use in water treatment. Probably the property most familiar to water works engineers and operators is the adsorption of the glassy phosphate on the surfaces of metals and their oxides and salts. This is the basis for the uses of Calgon known as "Threshold Treatment," which include prevention of the precipitation of calcium carbonate or lime scale[1] and the formation of thin phosphate films on metal surfaces to control corrosion.[2] This property, combined with the complexing and dispersion abilities of Calgon, makes it possible to prevent the precipitation of dissolved iron in iron-bearing water supplies.[3]

This paper was presented at a meeting of the Maryland-Delaware Water and Sewage Assn., and is published in *Water & Sewage Works* with permission of the Association.

Now, in making available an effective agent for cleaning wells, another striking characteristic of Calgon is applied in the water works field. One of the fundamental properties of the glassy phosphate is its pronounced ability to disperse finely divided metal oxides and salts, including calcium carbonate, clays and similar materials.[4] This action of Calgon is easily demonstrated.

Demonstrations of Dispersal Action

In Fig. 1 it will be noted that the 55 per cent calcium carbonate slurry in the left beaker shows no flow when inverted. The beaker on the right, however, shows good flow from a 70 per cent calcium carbonate slurry which is treated with Calgon. This fluidity is caused by the dispersing action of the glassy phosphate adsorbed on the calcium carbonate particles.

Fig. 2 gives a striking picture of the effect of Calgon on iron oxide. Prior to taking the picture, identical amounts of iron oxide sludge were placed in three graduated cylinders and made up to volume with water. To the second graduate was added 500 ppm of Calgon and to the third, 1000 ppm. No Calgon was added to the first cylinder. After thorough shaking, the cylinders were allowed to stand about two hours before the picture was taken. In fact, the iron oxide in the untreated sample settled to the bottom in only a few minutes time whereas that in the Calgon-treated cylinders remained in suspension after 24 hours.

The dispersing action of Calgon has been applied to the deflocculation of clays and pigments in the paper, ceramic, and paint industries; selective flotation of ores; and in oil field well drilling muds.

Dispersal Action Applies to Well Cleaning

But what has this to do with well cleaning? Let us consider the substances which cause the plugging and, therefore, restrict the capacity of wells. These include not only substances deposited from the water such as calcium carbonate and iron oxide but also clay, silt, and various inorganic minerals present in the strata. Typical constituents of suspended matter removed by well cleaning operations are shown in Table 1.

Table 1

SUSPENDED MATTER FLUSHED FROM WELLS

Well Location	Major Constituents	Minor Constituents
Chemical plant (southern Illinois)		
Well No. 1	Amorphous silica	Calcium phosphate, hydrated ferric oxide, calcium carbonate.
Well No. 2	Hydrated ferric oxide	Calcium carbonate, calcium phosphate.
Well No. 3	Iron carbonate, calcium phosphate	Feldspar, calcium carbonate, calcium sulfate.
Well No. 4	Calcium carbonate	Ferric oxide, feldspar, quartz, calcium phosphate.
Well No. 5	Quartz	Ferric oxide, silica, calcium carbonate and phosphate.
Industrial plant (near St. Louis)		
Well No. 1	Quartz	Particles of clay, ferric oxide (sulfide odor)
Well No. 2	Quartz, amorphous silica	Hematite.
Well No. 3	Hematite, hydrated iron oxide	Magnetite (sulfide odor); many bacteria present, including sulfate-reducing type.
Municipality (Illinois)		
1st flushing	Quartz	Magnesium silicate, calcium carbonate, ferric oxide.
2nd flushing	Magnesium silicate, calcium carbonate	Ferric oxide, quartz.

Fig. 1—DISPERSAL action of Calgon demonstrated using calcium carbonate slurry
A 55% slurry of carbonate (left) will not flow from a tilted beaker, but a 70% slurry when treated with Calgon (right) flows readily.

Reference to this table indicates substances of the type that are dispersed by Calgon.[5] It is notable that although some of these minerals, such as calcium carbonate and iron oxide or carbonate, could be dissolved by acid most of them would not have been affected by acid treatment. This confirms carefully observed field results indicating that the glassy phosphate is one of the most effective agents yet developed for restoring capacity of those wells in which screens or the aquifier around the well have been plugged by mineral deposits. In most cases the glassy phosphate treatment produces results superior to those obtained with inhibited acid.

Calgon Treatment Method

The procedure for cleaning wells with Calgon is a relatively simple one, and has been well standardized for application to most types of wells. A solution containing Calgon and hypochlorite, in amount depending on the volume of the casing, is poured into the well. The hypochlorite is included to alleviate any plugging caused by iron bacteria or other micro-organisms.

Generally, between 15 and 30 pounds of Calgon, and one to two pounds of hypochlorite are used for each 100 gallons of water in the well under static conditions.

With the pump and all other equipment left in place, the chemicals are allowed to remain in the well for 24 to 48 hours. During this period the pump is turned on and off 10 or 12 times at frequent intervals for surging. Fig. 3 illustrates the addition of a vertical pipe to permit surging a well having high standing water levels. If surging is not possible or desirable, equally good results usually can be obtained without surging by allowing the Calgon charge to remain in the well for at least one week.

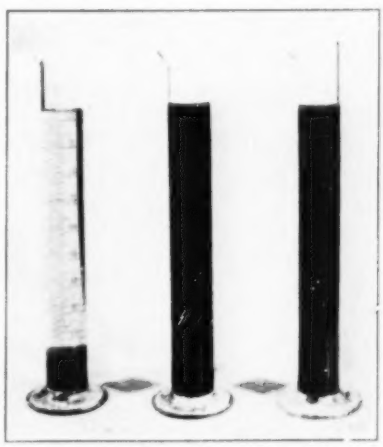


Fig. 2—EFFECT on iron oxide sludge
Untreated sludge in water (left) settles rapidly. Sludge treated with 500 ppm of Calgon (center) or with 1000 ppm (right) remains dispersed for 24 hrs.

The surging distributes the chemicals and also produces agitation which helps the Calgon loosen and disperse the deposits. After the last surging the well is flushed thoroughly to waste. The entire procedure should be repeated until no appreciable further improvement is noted. Normally two or three charges are sufficient for a thorough cleaning.

Generally speaking the greatest improvement in well capacity is observed after the first charge. The charge should, however, be repeated for check purposes. There have been cases of wells cleaned with Calgon that did not respond until the third or fourth charge of Calgon was applied. Some wells have required as many as five charges to produce optimum results. The reason for more than one cleaning is that Calgon is relatively slow acting compared with acid and frequently requires considerable contact period before it starts to loosen the cementing material.

Calgon treatment does not solve all well troubles. Obviously, mechanical failures or general depletion of the underground reservoir are responsible for loss in the production of some wells. Although it is rare, one

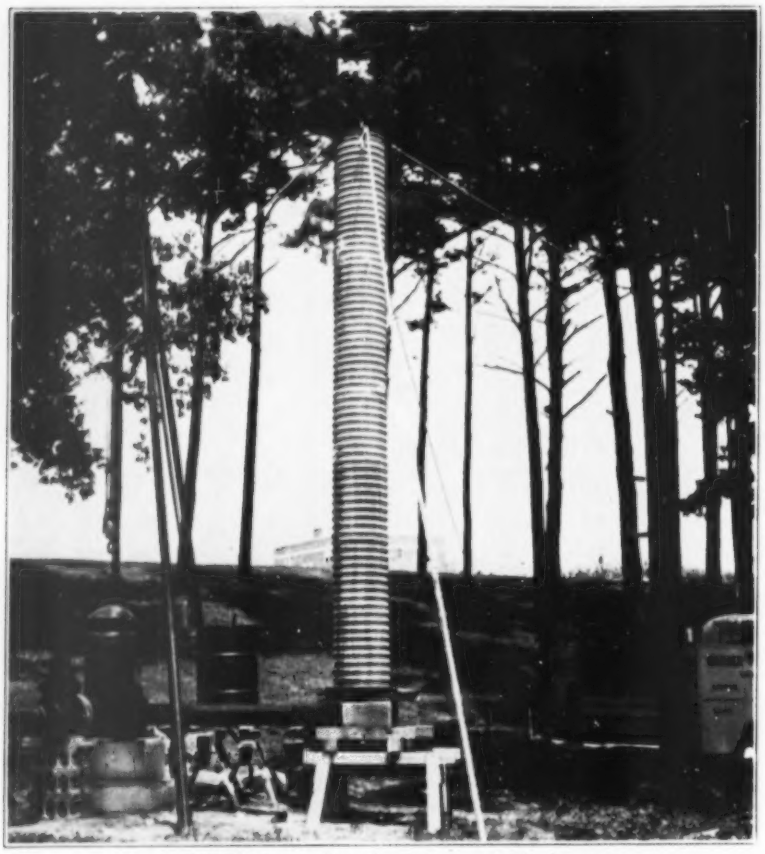


Fig. 3—SURGING a well in the Calgon method of treatment
The vertical pipe makes surging possible when the well has a high standing water level.

may encounter wells plugged by sand. Calgon will not remove the larger particles of fine sand, although frequently it is found that after Calgon cleaning the sand has been loosened to such an extent that back-pumping will back the sand away from the screen and out into the formation. As far as is known, the only remedies for sand-plugged wells are bailing and mechanical removal.

Reports of Experience

Field experience in cleaning wells with Calgon has been extensive and the treatment has been effective for 80 to 90 per cent of all wells cleaned to date. This is an excellent record, particularly when it is considered that Calgon has been tried many times when the difficulty was actually due to dropping water tables or mechanical failure.

Concrete Wells Retain Original Capacity

The first reported use of Calgon for cleaning wells was in 1943.[4] This application at a mid-west refinery was undertaken in an effort to find a means of cleaning a porous concrete well where acid cleaning would not be feasible.

Calgon treatment of this and twenty other wells at the same location effectively solved the problem.

The glassy phosphate is quite harmless to either concrete or metal during the contact period employed so that cleaning could be carried out with pumps and other equipment in place. Calgon proved to be safe to handle and no dangerous fumes or gases were generated by its use. Little supervision was found necessary when using glassy phosphate in well cleaning, and the chemical and labor costs were low.

These factors, together with the returning of all but a few wells to original installed capacities, prompted this refinery to establish a routine program for periodically cleaning all wells at intervals dependent on the rapidity of increase in draw down. Indications are that this procedure will prolong indefinitely the life of wells which previously had produced for only about five years.

Increasing Yield of Industrial Wells

At a Baltimore industrial plant, two wells have been cleaned successfully with Calgon. The first, a well less than a year old, originally met the guaranteed flow of 225 gpm only after acid treatment by the well driller. Nine months later, with production having fallen off to less than 150 gpm, the well was treated with Calgon. After cleaning, the output of the well increased to 275 gpm without draw down—exceeding output at the initial 225 gpm rate. This well has produced 250 to 275 gpm of water for almost two years without increased draw down and, in fact, can be pumped at a 300 gpm rate without dropping the level close to the top of the pump bowls.

The second cleaning job at this plant was done on a well approximately ten years old that had been acid cleaned previously. On this well, the output had decreased below 200 gpm and was returned to the original rate of 330 gpm after cleaning. Results on a third well at this plant have been discouraging after two charges were applied, but a third will be applied in an effort to produce results. The third charge should indicate whether or not this particular well will ever respond to Calgon cleaning.

Municipal Well Experience with This Treatment

An Ohio municipality has recently reported cleaning a 140 foot well having a 10 inch casing. Tests made before and after cleaning have indicated an increase in pumping rate from about 250 gpm to about 318 gpm, while the draw down decreased from 13.5 feet to 7 feet. This means that the specific capacity in gpm per foot of draw down increased from 18.4 to 45.5—or an improvement of 147 per cent.

It is not unusual for wells cleaned with Calgon to develop capacities higher than when new. At one Midwestern municipality, the original specific capacity of a new well was 20 gpm per foot of draw down but had dropped sharply after only a year of operation. Acid cleaning restored the original capacity. Although doubtful of further improvement the municipal authorities consented to try cleaning with glassy phosphate. One charge of 200 pounds of Calgon plus hypochlorite was used, and surging was carried out for only 24 hours. Specific capacity increased to 40 gpm per foot of draw down—a 100 per cent increase over that when the well was new. Material cost for Calgon cleaning was only $35.00, compared with the cost of the first cleaning using 1700 gallons of acid.

A Maryland plant depends for a portion of its supply on a well water high in dissolved iron content, concentrations varying between 20 and 25 ppm. The use of air lift pumping

of this well quite expectedly produces rapid plugging with iron oxide deposits and reduction of output. Periodic mechanical cleaning at about twelve month intervals had been resorted to as a means of restoring capacity but had never produced a delivery higher than 90 gpm, whereas original rated capacity of the well was 135 gpm.

Recently, after a 14 month period of operation following the last mechanical cleaning had resulted in reduction of capacity to 4 gpm, it was decided to chemically clean the well using Calgon and hypochlorite. The first chemical charge and cleaning procedure increased capacity to only 20 gpm. However, a total of four charges were used and checks after each period indicated successive improvement to 70 gpm after the second charge, 110 gpm after the third, and finally after the fourth charge an output of 153 gpm was obtained. This cleaning procedure not only produced better results than mechanical cleaning and an output exceeding initial rated capacity by 13 per cent, but proved more economical in outage time, and in costs of labor and material.

Reduced Pumping Costs

Not insignificant are the savings in pumping costs resulting from cleaning wells with glassy phosphate. A well in New Mexico had a draw down of 290 feet when pumped at 250 gpm. Calgon cleaning increased the specific capacity by approximately 75 per cent in one treatment. The reduction in pumping head amounted to a saving of about 135 kilowatt hours per day, which at two cents per kilowatt hours adds up to a saving of about $1000.00 per year.

At an industrial plant operating eleven wells, some with concrete casings, the glassy phosphate cleaning procedure was applied by one plant engineer after trying acid to check rapid loss of well capacity. The acid procedure was found to be expensive and cumbersome, and some concrete wells were damaged. On one of these wells, having a specific capacity of 14 gpm per foot of draw down, acid cleaning brought the output up to 400 gpm. Subsequent cleaning with Calgon shot the output up to 1,200 gpm, which corresponded to a specific capacity of 30 gpm per foot of draw down. The rehabilitation program at this plant increased total capacity of the eleven wells from 6446 gpm to 8657 gpm—a 34 per cent gain—while reducing draw down by 21 per cent. The corresponding reduction of 9.2 per cent in total pumping head accomplished appreciable savings in pumping costs.

Calgon Method Works on Shallow Wells

We have thus far reported only on the cleaning of deep wells. It is noteworthy that with slight modifications, this cleaning procedure has been applied successfully to large diameter relatively shallow wells. In New England, large diameter wells have been cleaned by sealing and by providing necessary agitation using compressed air.

On other large diameter wells it has been found necessary to sink a series of well points around the periphery of the well, and thus to recirculate the strong solution of Calgon through the strata. Using this method it has been possible to clean a porous concrete well 4 feet in diameter and only 30 feet deep that could not be surged with compressed air because the casing was made in 4 ft. sections that would not stand surging pressure. Original fears that pumping of the turbid wash water through the strata would result in plugging due to filtering action were proven unfounded by the 85 per cent increase in capacity. Apparently the glassy phosphate dispersed the suspended matter so completely that none of it lodged in the sand and gravel trata.

Summary

The dispersive effect of the glassy phosphate Calgon on those substances which most frequently plug well screens and the surrounding strata, makes available a most effective agent for cleaning wells. The method is simple and is generally applicable to all types of wells. The chemicals required are readily available, safe to handle and low in cost. The proceedure is useful to help develop new wells or to restore capacity of old wells.

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A "Thermometer" for Rivers Calibrated in Diatoms

A "thermometer" to determine the health of rivers and streams has been developed by scientists of the Philadelphia Academy of Natural Sciences.

Dr. Ruth Patrick, curator of limnology conceived the idea. The "thermometer," believed to be the first of its kind, measures about two feet in length and consists of a series of glass slides on a plexiglas frame supported by two floats.

It is anchored in mid-stream where tiny microbiological units called diatoms collect on the glass slides. By studying the diatoms—their species and condition—scientists can tell if the water is healthy. Dr. Patrick said the job of collecting diatoms previously was time-consuming and involved much work. Now the study can be done in less than two weeks.

Scotland Highland Is Dead

Scotland G. Highland, who for 44 years of his life served the people of Clarksburg, W. Va. during his connection with their water works died on October 23rd.

"Scot" Highland never married, had always as his first interest the water supply of Clarksburg. He had served the Clarksburg Water Board as senior engineer, superintendent, secretary-treasurer and general manager. He had retired only a brief time prior to his death.

Mr. Highland was a Life Member of the American Water Works Assn. and for many years never missed a convention of the association. He was responsible for numerous improvements to Clarksburg's water treatment plant and distribution system. He was also a member of the Am. Soc. of Civil Engineers and a past-chairman of the W. Va. Section of A.W.W.A.

"Scot" Highland was first, last and always a water works man—the only water works man to actually own a small church located on ground adjoining the Highland ancestral home.

Report of the S & IW Federation's 26th Annual Meeting in Miami

I—The Highlights of a Busy and Successful Program

THE meeting in Miami, Florida, on October 13-16, 1953, marked the start of the second quarter century in the life of the Federation of Sewage and Industrial Wastes Associations. Its four-day program was a busy and successful one, and the registration topped 800—with 606 men and 199 ladies in attendance.

The host association to the convention, the Florida S&IW Assn., did an outstandingly good job in arrangements and in entertainment. Meeting facilities in the city's Bayfront Auditorium (for technical sessions and for exhibits) were above reproach, and hotel facilities were fully adequate.

Sunshine and Showers

These advantages were predictable: the weather was not. For the record, some mention should be made of the alternating sunshine and showers that characterized this convention. One member said, "I arrived in Miami between rainstorms and from then until the time I left it was a question of whether or not I would be soaked before getting across the street to the auditorium."

Only at two times, however, was the rain a serious inconvenience: on Wednesday, following the Federation luncheon, when it delayed the return of members to the afternoon session; and on Friday morning it reduced attendance at the Operators' Forum.

More Important Considerations

The exceptionally fine technical program, the many items of business, and the varied social events are features of the Miami meeting which those who attended will long remember. There were seven technical sessions, of which one was an industrial wastes forum and one an operators' forum. There was a Federation luncheon and a business luncheon of the Florida Association. New officers were elected, and Federation members were honored by awards.

Incoming President
L. J. Fontenelli
Superv. Engr.
Rahway Jt. Meeting
Garwood, N.J.

Officers
Retiring President
E. S. Chase
Partner
Metcalf & Eddy
Boston, Mass.

New Vice-Pres.
David B. Lee
Dir. & Chief Engr.
San. Eng. Bur., S.H.D.
Jacksonville, Fla.

There were 37 exhibitors displaying the latest developments of equipment for the sewage and waste field—in a total of 64 booths. To see and discuss these new and useful devices may be of as much value to Federation members as are the technical sessions.

Officers

Exec. Secretary
W. H. Wisely
Exec. Secy.-Editor
F.S. & I.W.A.
Champaign, Ill.

Treasurer
W. W. DeBerard
City Engr.
Pub. Wks. Dept.
Chicago, Ill.

The 1954 meeting of the Federation will be held in Cincinnati.

New Officers

Officers serving the FS&IWA for the coming year will be:

President—Louis J. Fontenelli, Supervising Engineer, Rahway Valley Joint Meeting, Garwood, N. J.

Vice-President—David B. Lee, Director and Chief Engineer, Bur. of San. Eng., State Bd. of Health, Jacksonville, Fla.

Treasurer—W. W. DeBerard, City Engineer, Bureau of Eng., Dept. of Public Works, Chicago, Ill.

Secretary—W. H. Wisley, Exec. Secy.-Editor, FS&IWA, Champaign, Ill.

Director-at-Large—V. G. Mackenzie, Officer-in-Charge, Env. Health Center, U.S.P.H.S., Cincinnati, Ohio (for a three-year term).

Honorary Members

The Federation conferred honorary membership upon:

Dr. Karl Imhoff, Cons. Engr., Essen, Germany, and

Harold W. Streeter, San. Engr., U.S.P.H.S., Cincinnati, Ohio.

Medals Awarded

The following members were awarded Federation medals:

Donald M. Pierce, San. Engr., State Dept. of Health, Lansing, Mich. —The *Harrison Prescott Eddy Medal* for an outstanding contribution in research (his paper on the split chlorination of sewage).

W. N. Wells and Clarence H. Scherer, respectively, Supt. of Sewage Treatment, San Antonio, Texas—

FEDERATION Weather—Miami was a changing scene of sunshine, rain, and sunshine again

Honorary Members

Dr. Karl Imhoff
Cons. Engr.
Essen
Germany

H. W. Streeter
San. Engr.
U.S.P.H.S.
Cincinnati, O.

the *George Bradley Gascoigne Medal* for an outstanding contribution in plant operation.

DR. WILLIAM D. HATFIELD, Supt., Sewage Treatment Plant, Decatur, Ill.—The *Charles Alvin Emerson Medal* for meritorious service to the Federation (especially for his long and faithful leadership of the Standard Methods Committee.

RICHARD HANSON COE, Research Technologist, Shell Oil Co., Wilmington, Calif.—The *Industrial Wastes Medal* for an outstanding contribution to the control of industrial wastes (his paper on oxidation of refinery wastes by the A. S. process).

Presentation to Incoming President

The new president of the Federation, LOUIS J. FONTENELLI, was presented with a wrist watch and plaque by SOL SEID, the president of the New Jersey Sewage and Industrial Wastes Assn.

Bedell Award Winners

Twelve recipients were selected by member associations to receive the 1953 *Arthur S. Bedell Award* for extraordinary service to his association:

ARTHUR THOMAS WINTERSGILL
California
NATHAN MEREDITH DEJARNETTE
Georgia
JOHN B. KLEVEN
Dakota
RALPH EDWARD FUHRMAN
Maryland-Delaware
F. F. PALMER
Montana
WALTER E. MERRILL
New England
ANTHONY J. FISCHER
New York
CHARLES G. CALDWELL
Rocky Mountain
EUGENE C. MEREDITH
Virginia
HENRY WITHERS SPEIDEN
West Virginia
DOUGLAS LAUCHLIN MCLEAN
Canada
ROBERT JAMES AULD
Puerto Rico

The Oklahoma Water, Sewage and Industrial Waste Conference is also eligible to nominate a candidate for the 1953 Bedell Award, and is expected to take that action at its conference in November.

Federation Luncheon

Speaker at the Federation Luncheon was DR. WILSON T. SOWDER, State Health Officer, State Board of Health, Jacksonville, Fla., who discussed "Sanitation Problems in Florida."

He pointed out that, in only 30 years, Florida has grown from a rural state of small communities to one of medium size cities and several metropolitan areas. Water supplies for these communities, and for citrus, phosphate, paper and pulp industries must be provided and protected. There are corresponding problems of sewage and waste treatment: Since the end of World War II, thirty sewage plants have been placed in operation, and many more are being constructed. Growth of population has been so rapid, however, that the per cent of sewage treated has decreased.

Committee Chairmen

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Gen. Mgr.
W & T Co.
Newark, N.J.

Convention
T. T. Quigley
Representative
W & T Co.
Newark, N.J.

Emerson Medal
Dr. W. D. Hatfield
Superintendent
Sewage Tr. Plant
Decatur, Ill.

Eddy Medal
Donald M. Pierce
San. Engr.
State Health Dept.
Lansing, Mich.

A 50 per cent increase in population has taken place in the last ten years, much of it in fringe areas. New or improved sewage treatment facilities are needed in many areas—the field for consulting engineers and for equipment manufacturers is large and expanding.

The industrial waste situation is in need of correction, even though few wastes are potential disease hazards: very little treatment is actually practiced, though feasible solutions have been indicated for citrus wastes. Research studies have been financed to investigate phosphate waste treatment.

New laws have recently been passed which make it a criminal offense to discharge wastes without approval of the State Board of Health. Enforcement by police power is extremely difficult, but Dr. Sowder considers that substantial progress will be accomplished by means of an educational campaign.

Social Events

The program included two busy evenings: the first was Family Night Entertainment, an informal event planned for recreation and pleasure; and the second was the Federation Awards Dinner, where award presentations were made, followed by dancing at the Biscayne Terrace Hotel.

In addition to these evening events, the program for the ladies included a Get-Acquainted Tea, a Bus Tour of Miami and Vicinity, and a Boat Trip on Biscayne Bay (and a number of men look to advantage of this trip).

One evening was free—for visiting some of the many manufacturer's open-house hotel rooms, it appeared. Miami and Miami Beach offered an endless number of attractive dining places—especially noted for sea food dishes—and these, too, were focal points for the convention.

Convention Committees

Successful conventions do not just happen, but are the result of much hard work by many individuals. All committees deserve credit and recog-

EVENING EVENTS—Left to right: (1) Family Night entertainment, the audience and (2) one of the unique acts, "Ferdinand the trained bull." (3) After the Awards Dinner, members move to (4) the Biscayne Terrace Hotel for dancing, the final event.

N. M. de Jarnette
Assoc. Dir.
Polln. Control, S.H.D.
Atlanta, Ga.

R. E. Fuhrman
Dept. Dir.
San. Eng.
Washington, D.C.

Some of the Bedell Award Winners

F. F. Palmer
City Engr.
Forsyth, Mont.

W. E. Merrill
Pub. Hl. Engr.
State Health Dept.
Boston, Mass.

A. J. Fischer
Devel. Engr.
Dorr Co.
Stamford, Conn.

E. C. Meredith
Asst. Engr.
State Health Dept.
Richmond, Va.

nition for an outstanding meeting in Miami—to these committees and their chairmen we offer our appreciation for a "job well done":

Convention Management
T. T. Quigley, Chmn.
Local Arrangements
C. F. Wertz, Chmn.
Program
F. W. Gilcreas, Chmn.
Rolf Eliassen, Vice-Chmn.
Publicity
L. H. Enslow, Chmn.
Hotel Arrangements
J. A. Stevens, Chmn.
Registration
D. P. Schiesswohl, Chmn.
Finance
J. R. Hoy, Chmn.
Entertainment
A. B. Kononoff, Chmn.
Ladies Entertainment
N. D. Hoy, Chmn.
Local Host
B. F. Borden, Chmn.

Technical Sessions

E. Sherman Chase, retiring president, presided at the opening technical session. President Chase provided, and requested program chairman Gilcreas to read as the first order of business, the following poem which first appeared in the *Saturday Evening Post:*

I love a finished speaker,
I really, truly do.
I don't mean one who's polished,
I just mean one who's through!

With this introduction, the technical program was conspicuously on time. The credit for this welcome feature, however, should probably be given to the relentless warnings, the alarm timer, and the three-way signal device which the program chairman uses to control speakers.

Miami's New Sewage Plant

"The Virginia Key Sewage Treatment Plant of the City of Miami" was described in a paper presented by John S. Bethel, Jr., Partner, Metcalf and Eddy, Boston, Mass.

Officially, the construction of the Miami plant started on August 17, 1953. The immediate average capacity of the plant will be 47 mgd; three years will be required to complete it;

Committee Chairmen

Local Arrangements
C. F. Wertz
Research Engr.
W & S Dept.
Miami, Fla.

Local Host
B. F. Borden
Engr.
Smith & Gillespie
Jacksonville, Fla.

and eventually it will treat all sewage from the city. Site of the plant is an Island located 3 miles southeast of the downtown center of Miami, and forming a part of the shore of Biscayne bay. Secondary treatment will be provided by a "high rate activated sludge" process, and the effluent will be chlorinated prior to discharge to the Atlantic ocean through outlets one mile offshore.

Miami laid its first sewers in 1906, and treatment of sewage has become an increasing need as the city's population grew to its permanent size of 250,000 and its increase in winter to 350,000. An estimated 65 per cent of the winter population is connected to sewers, and the sewage from 230,000 now discharges through 70 outlets into Biscayne Bay, the Miami River and the Little Miami River (both rivers discharge into the bay, which is shallow, averaging 5 to 6 feet deep at high tide). Gross pollution of the waterfront and far out into the bay has been the result.

LUNCHEON speaker, Dr. Wilson T. Sowder, Health Officer of Florida, with David B. Lee, new FS & IWA Vice-Pres.

The State Board of Health surveyed this area in 1949 and, subsequently, the city retained the Miami Sewer Project Associates to report on and to prepare plans for abatement of the pollution. (The "Associates" include two Miami firms, Maurice H. Connell and Assoc., Inc., and the Rader Engineering Co., and Metcalf & Eddy of Boston.)

The proposed works include intercepting sewers, several small and two large pumping stations, to collect and deliver all sewage through a 72-inch reinforced concrete force main across Biscayne Bay to Virginia Key, the treatment plant, and the outfall line. While the city has separate storm water sewers, flows beyond the capacity of the pumping stations may occur; these will be discharged directly from the pumping stations after chlorination.

Sludge handling facilities have been designed to serve an estimated population of 283,000 persons—anticipating that larger sludge volumes can be handled during the winter months by utilizing the digestion tanks to store digested sludge beyond the capacity of sludge dewatering and incinerating units; and, if necessary, by increasing the average days operation from 5 to 6 days per week.

Primary treatment of sewage is to consist only of grit removal. The high rate aeration will involve the return of a "smaller than standard" quantity of activated sludge from the

F. W. Gilcreas (Chmn.)
Asst. Dir.
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Albany, N.Y.

Rolf Eliassen
Prof. of San. Eng.
Mass. Inst. of Tech.
Cambridge, Mass.

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Sr. Civil Engr.
Pub. Wks. Dept.
Pasadena, Calif.

F. W. Mohlman
Dir., Lab. Div.
San. District
Chicago, Ill.

final settling tank. Excess sludge is to be concentrated, digested, elutriated, dewatered, and incinerated. Sludge gas will be used as fuel for gas engines driving blowers and generators.

At the pumping stations, prechlorination will be included to control odors, to prevent slime formation in the force main, and to retard sewage decomposition.

The plant capacity will provide an aeration period of 2.75 hours. Return sludge may be discharged either into the aeration influent channel, or into the head of the first pass of each aeration tank (each tank consists of four passes). A foam control system is designed to employ water sprays using strained final effluent. The final tanks are conventional rectangular units providing 2.5 hours detention. Because there is no primary clarifier, scum collecting mechanism is included in the final tank. The exposed location of the plant has necessitated the provision of special protection against hurricanes.

The author's firm has designed the treatment plant and the outfall sewer, and is supervising their construction. Cost of plant construction will be approximately $9.22 million, and of the outfall line $1.7 million.

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Manager
John G. Stewart
Manager
W & W Mfrs. Assn.
New York, N.Y.

W & SW Manufacturers' Assn., Inc.

Treatment Plant Design in Warmer Climates

"Sewage Treatment Plant Design Criteria Applicable to Semi-Tropical Climates" was the title of a study reported by Thomas deS. Furnam, Assoc. Prof. of Civil Engineering, San. Eng. Sec., Engineering and Industrial Exp. Sta., Univ. of Florida, Gainesville, Fla.

Professor Furman investigated usable native materials and reevaluated design standards, with the intent of reducing the cost of sewage treatment while still keeping streams, lakes and beaches free from pollution. He described the detailed studies of primary sedimentation, intermittent sand filters, trickling filters, and sludge disposal processes.

His results indicate that design criteria applicable to colder climates may be revised for facilities to be built in the semi-tropics, and thus reduce the initial costs of installation.

The detention time required for primary units may be lowered: two hours is the maximum required.

Intermittent sand filtration was found economical for small installations requiring a high degree of treat-

FEDERATION fishermen—a few who found the fishing fine

Left to right: (1) Roe Falciani, of Albright and Friel, Philadelphia; Stan Kappe, Cons. Engr., Washington, D.C.; John Gruss and George Fieldhouse, Albright and Friel. (2) Mark Owen, Cons. Engr., Indianapolis. (3) E. H. Thwaits, V.P., Preload Engrs., Inc., and Mrs. Thwaits, Alexandria, Va.

Constitution
C. A. Emerson
Cons. Engr.
Havens & Emerson
New York, N.Y.

Nominating
V. M. Ehlers
Ch. San. Engr.
State Health Dept.
Austin, Texas

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ment. Florida sands ranging from 0.35 mm to 1.04 mm can adequately treat from 175,000 to 400,000 gal. per acre per day, using a dosing cycle of twice each day.

Acceptable media for the construction of trickling filters are Brooksville limestone and Chattachoochee river gravel. It has been found that, in a semi-tropical climate, a four foot filter depth may be adequate, and the rate of B.O.D. removal accomplished is somewhat greater than normal.

Standard rate trickling filters may be loaded in excess of the 4.0 mgad rate now specified by the State Health Department, and still accomplish satisfactory removals. Sludge drying areas may be reduced substantially below those normally specified for colder climates.

How Sewage Effluents Affect Lakes

"Factors Involved in Lake Disposal of Effluents" were reviewed in an exceptionally well illustrated and presented paper, by Clair N. Sawyer, Professor of Sanitary Chemistry, Dept. of Civil and San. Engr., Mass. Institute of Technology, Cambridge, Mass. Briefly, he pointed out that, since fertilizing materials enter lakes from ground waters and tributary streams, an evaluation of the amounts contributed from these sources is necessary before it becomes possible to estimate what might be the safe loading of sewage effluents.

Water quality preservation in lakes is somewhat different than the situation in flowing bodies of water such as rivers. Today the considerations of dissolved oxygen or of coliform counts are not as important as are the insidious conditions resulting from development of prolific algal blooms.

Fundamental considerations are: Over 70 per cent of the U.S. population is non-agrarian, mostly located in centers of population served by sewers. Products of farms are constantly siphoned to urban areas where they are processed and consumed. The major part of fertilizing materials reaches sewers in the form of human wastes. In summary, the average man during his lifetime (65 years) consumes fertilizing material totalling 34,500 pounds and discharges to the sewer some 840 lb. of nitrogen, 80 lb. of phosporus, and 175 lb. of potassium.

Whether these elements are discharged untreated or receive treatment, they reach streams as plant foods. Newer knowledge of the nutrition of algae gives proof that sewage contains all the ingredients necessary to support luxurious growth: an ultimate yield of about 2,000 lb. per million gallons of sewage can be expected.

Professor Sawyer listed actual sources of plant foods (ground water, surface runoff, etc.) and potential sources (the atmosphere). Permissible nutrient or fertilizing minerals which may be discharged in sewage or wastes, therefore, are determined by climatic factors, physical factors, biological and chemical factors.

Harold B. Gotaas, Professor of Div. of Civil Eng. and Irrigation, College of Engineering, Univ. of California, Berkeley, Calif., prepared a discussion of the paper which was read in his absence by Robert S. Ingols, Research Chemist, Eng. Expt. Sta., Georgia Institute of Technology, Atlanta, Ga.

Professor Gotaas reported that algae may readily be grown in raw sewage, symbiotically with bacteria. The blue-green algae growing readily in wastes do not grow well in ponds. Floating algae generally are dead algae.

To grow algae commercially, algae must be removed from effluents—and a method of doing this has not been developed. While the optimum temperature for algal growth is 25°C, they can be grown in the range of 10° to 30°C.

Dr. Ingols commented that, in Georgia, the turbidity of lake waters is relatively high; readily weathered rocks supply nutrients; the water temperature is about 15°C; and large concentrations of plankton are found.

James B. Lackey, Prof. of San. Science, San. Eng. Research Sec., Eng. and Indus. Expt. Sta., Univ. of Florida, Gainesville, Fla., presented the second prepared discussion of Professor Sawyer's paper.

Dr. Lackey emphasized the relation between control and concentration, and noted that some algal blooms are to be encouraged while others are not desirable. Some ponds are fertilized for fish production. Certain blooms, such as the "Red Tide," are responsible for fish kills. He reviewed specific instances of nuisance creation; i.e., pollution by duck farm wastes in the Great South Bay area of Long Island, N.Y.

The question he considers must be answered: "Shall we utilize nutrients as plant food or allow them to become algal nutrients? When we can *recover* nutrients, then nuisances may be a thing of the past, and a conservation - management program should be able to accomplish this.

Smog the Latest Objection to Sewage Disposal Works

The Los Angeles City Council has authorized an appropriation for a $6085 installation of a pilot smog-prevention device at the Hyperion sewage disposal plant.

A catalytic device invented by Dr. Eugene J. Houdry will be installed at Hyperion and if the pilot model is successful in trapping smoke and fumes it will be followed by a full-scale system.

> No one has ever created a great thing suddenly.—*J. Wanamaker*

WATER WORKS PRACTICES

OPERATION • MAINTENANCE • MANAGEMENT

Source of Supply
Part 3—Impounding Reservoirs

The Seventh of a Series

by **GEORGE E. SYMONS,** ***Ph.D., Consultant & Technical Editor***
Larchmont, N. Y.

CONTINUING the discussion of "Source of Supply," we return to the subject of surface waters and how they are stored. As pointed out in Lecture No. 5, Impounding Reservoirs are basins created on a surface stream to store runoff from the watershed.

This article is one of a series on the general subject of "Water Works Practices," developed by Dr. Symons in the simple style of a short course lecture and designed to be of interest to small plant operators, new operators, students and any others who may wish to review the fundamentals of the subject.—*The Editors*

A. . . . Impounding Reservoirs

1. YIELD

a. The *yield* of a watershed consists of the total precipitation on a watershed, less the evapo-transpiration, that is, the yield is the direct runoff plus that water which percolates into the ground and then passes into the stream. Yield is calculated in gallons per year or per day.

b. *Safe yield* is the minimum recorded or estimated volume for any given past or future period under the most adverse conditions.

c. *Draft* is the actual quantity of water that will be drawn from the stream for use.

d. The function of an impounding reservoir is to store the water from a watershed during high flows or wet years for use when the stream flow is less than the draft demand. . . . If the minimum daily flow is not well above the maximum daily draft which must be supplied by the project, then the yield of the watershed must be increased by an impounding reservoir.

2. SITE SELECTION

a. The location of an impounding reservoir frequently is determined by the location of the stream with reference to the municipality, but there are other factors.

b. Factors to be considered in the selection of a reservoir site include:

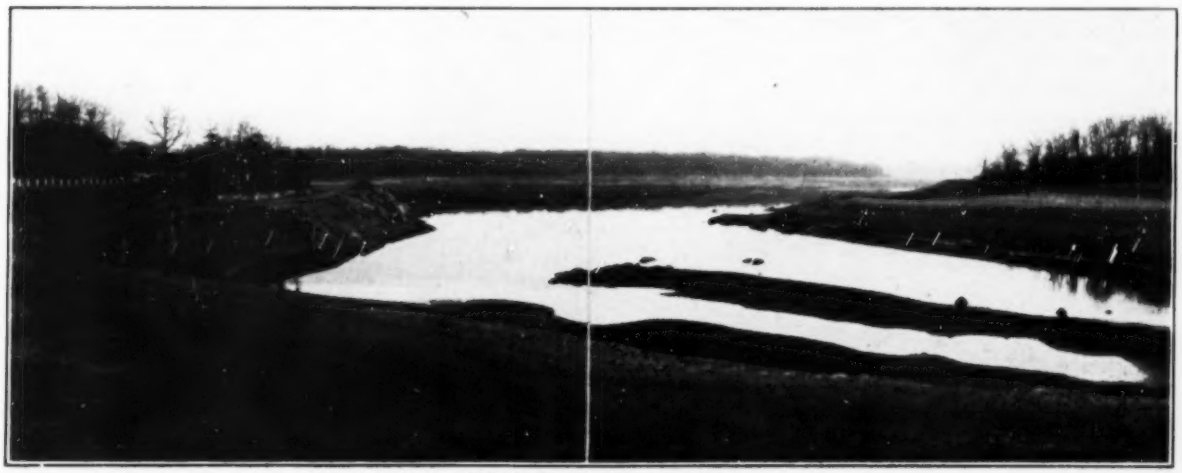
1—Area: The area devoted to an impounding reservoir should not be more than five per cent of the total area of the watershed.

2—Geology: That is, the character of the soil, underlying rock and presence of soluble minerals that might be objectionable.

3—Topography: A narrow opening in the valley to reduce the length of dam required and a rapidly widening valley to allow greater volume of water per foot of dam height and length.

4—Submerged Lands: The area inundated by water should be inexpensive and contain few houses, highways, railroads, etc.

5—Vegetation: There should be few trees and underbrush to be removed and the type of vegetation



RESERVOIR with clean shore line

SPILLWAY of Wanaque Reservoir, North Jersey Distr. Water Supply Commission

should not include that which will create objectionable tastes, odors, or color in the water (as would occur from marshy lands).

3. Site Preparation

a. The extent of preparation of the site will vary with the location and with the ideas of the designing engineers.

b. Where thorough preparation is indicated or desired, it will include these steps:

1. Remove all human habitations, stables, barns and other possible sources of pollution.

2. Cut all trees and shrubs close to the ground over the entire area to be flooded.

3. Burn all grass, weeds and shrubs.

4. Prepare shores to a depth of 20 ft. by removing stumps and roots, etc., and create even slopes to minimize wave action on shores.

5. Strip the bottom soil, particularly in swampy or shallow areas.

6. Line the reservoir with soil low in organic matter (or with concrete or masonry in small basins) and riprap the shores with stone, etc. The principal purpose of the riprap is to prevent erosion by wave action on the shores.

c. Stripping a site of all vegetation and marshy land areas is an expensive operation but will eliminate difficulties due to tastes, odor and color when the reservoir first goes into service.

. . . After the reservoir has been in service for a time there is little difference in quality of water between a stripped and an unstripped reservoir.

4. Required Capacity

a. To determine the requisite reservoir capacity, it is necessary to know the average daily stream flow during the longest and driest period on record and to compare this flow with the average daily demand over the same period (or the predicted demand for such a period). The period should cover at least three years if possible.

b. By constructing a mass diagram, which is a cumulative curve of the flow and the demand, and by comparing these curves, it is possible to calculate the actual reservoir capacity required.

c. To measure the volume of water in an impounding reservoir, it is necessary to have contour elevations and to know the vertical distance and the surface area between the contour lines. A simple formula may be used:

$$V = \frac{h}{6}(A_1 + 4A_2 + A_3)$$

where V = volume between contours corresponding to surface areas A_1 and A_3,

A_1, A_2, A_3 = respective areas enclosed with a lower, middle and an upper contour line, whose contour interval is h,

h = contour interval or height in ft. between contour lines.

5. Losses

a. Evaporation and seepage are natural losses which must be considered in determining the capacity of a reservoir.

1. Evaporation will depend on surface area, wind action, temperature, humidity, barometric pressure, vapor pressure of air and water, etc. Formulas exist for calculating these losses.

2. A study at Oklahoma City in 1950-51 indicated a range in evaporation rates from 0.6 to 8.8 in. per month, with an average for the year of approximately 5.0 in. per month.

3. Seepage will depend on type of underlying soil and the surrounding water table. Rate of seepage is not easily determined.

b. Compensation water is water that must be released downstream to provide for persons who have water rights below the dam. This loss must be considered in planning the capacity of a reservoir.

6. Siltation

a. Silting of a reservoir occurs due to the deposition of finely divided soil particles or turbidity which settles out in the quiet waters of the reservoir.

b. Amount of silting is dependent on the silt load of the tributary stream, which is affected by climate, rainfall, topography, geography and ground cover of the drainage area.

1. Approximate engineering formulas are available to estimate quantities of silt delivered to a reservoir.

2. Reports of long time siltation records show wide variations for different reservoirs in reference to capacity loss by silting: A percentage low of 0.1 per cent capacity loss per year for Lake Purdy on the Little Cahaba River in Alabama, equal to 46.21 acre ft. per 100 sq. mi. of drainage area per year for a watershed area of 41.74 sq. mi.; a percentage high of 7.35 per cent per year

for New Lake Austin on the Colorado River in Texas, equal to 6.1 acre ft. per 100 sq. mi. of drainage area for a water shed area of 38,200 sq. mi. Large drainage areas, however, do not necessarily mean a high capacity loss per year or great depths of silt per acre per 100 sq. mi. of drainage area.

c. Loss of reservoir capacity due to silting is an important factor to consider in the design and planning of a reservoir.

d. Controlling siltation.

1. Prevention of soil erosion on the watershed is better than any attempt to remove the slit after deposition.

2. Control of sluice gates and water flow at flood stage helps to scour out the silt, but this is only partially effective.

3. Control of flows through the reservoir to take advantage of the density currents.

. . . Density currents or flows are created by the fact that water containing the silt is heavier than clear water. It will often move through a reservoir, along the bottom and out, with very little sedimentation taking place, because the velocity of this dense current along the bottom is too rapid to allow settling.

4. Jetting silt to channels at low water stage for later removal by scouring velocities of flood flows, and dredging or excavating when the reservoir is nearly empty, are expensive operations.

7. Effect of Storage

a. Turbidity and bacteria both are removed by sedimentation in prolonged storage.

b. Color will diminish on storage due to sunlight, aeration, sedimentation and other aquatic factors.

c. Temperature of water increases on storage in warm seasons.

d. Catchment area for reservoir has its effects; swamps and ponds contribute to "blooms" of algae and other organisms.

e. Slope of reservoir shores, size of reservoir and depth have a bearing on organic growths. Large shallow areas are bad; irregular shorelines increase the weed growth.

f. Control of algae and weed growth will be discussed in a lecture on tastes and odors, because these procedures are a part of operation techniques.

8. Watershed Sanitation

a. Control and policing of watershed sanitation depends on the amount of treatment to be given the water.

1. Untreated supplies can tolerate no habitation and no recreation on the watershed. If chlorination is practiced, less vigilance is required.

2. Complete treatment removes objections to bathing, fishing and hunting except on an aethestic basis.

3. Considerations must be given to possible breakdown of treatment works; therefore dependence for guidance should be placed on the state health department.

b. Rules for watershed sanitation have been laid down by Prof. Ernest Steel of the University of Texas, as follows:

1. Recreational use should be allowed only where there is a real need on the part of the public.

2. Regulation should be by caretakers with police authority.

3. Picnicking should be restricted to areas with garbage cans and sanitary toilets.

4. Bathing should be permitted only in large reservoirs, at least one mile from the intake, and restricted to definite beaches.

5. Boating, shooting and fishing may be allowed within 200 yd. of the intake.

6. Farmhouses on watershed should have toilets that will not pollute surface waters.

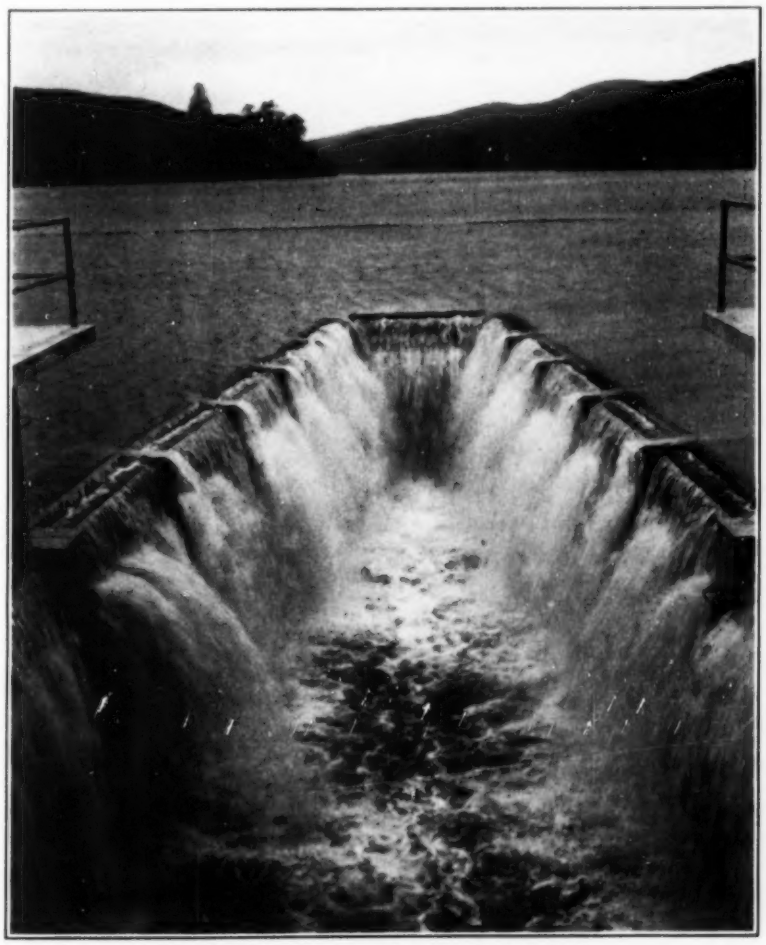
7. Sewage from any community on the drainage area should be treated.

9. Other Problems

a. Construction of impounding reservoirs brings other problems besides silting and watershed protection, such as effects on public health, areas of flooded land, routing floods through the reservoir and control of aquatic growths.

b. Public health problems may include mosquito breeding and malaria, safety, industrial development as well as watershed protection.

c. Flood control is discussed later in this lecture, but control of quality and aquatic growths is essentially a function of operation and will be presented in a subsequent lecture.



OVER-FLOW weir on one of San Francisco's reservoirs

WANAQUE reservoir, dam and head-works

B. . . . Dams

1. PURPOSE

a. Reservoirs can seldom be created without the construction of a dam of some sort; thus the creation of storage is the primary function of dams.

b. Control dams, called "diversion dams," are used to maintain water level in a stream above the intake level or to provide gravity transportation to pumps and reservoirs, or to maintain a minimum depth in a suction well.

2. TYPES OF DAMS

According to Prof. Harold Babbitt of the University of Illinois, dams are classified in two ways:

1. According to materials of construction
   Earth (rolled fill), hydraulic fill or semi-hydraulic fill
   Rock fill
   Rock filled timber crib
   Masonry (stone or concrete)
   Timber
   Steel
2. According to basis on which they resist external stresses
   Solid gravity (straight, curved or arched)
   Hollow gravity (slab and buttress, multiple arch, multiple dome)
   Arch (constant angle or constant radius)

3. DAM SITES

Best choice of site for a dam is that location which will provide the necessary height to give the required storage level. This choice must, however, give consideration to foundation conditions which must be O.K. geologically, with no faults.

4. EARTH DAMS

a. Details which require consideration include: Embankment slope, slope protection, top width, freeboard, berms, quality and location of material used in embankment, cut-off walls, core walls, drainage on downstream face, protection against creep, etc.

b. Examples of Details:

1. Embankment slope is governed by stability of material when wet; the bearing power of the foundation, and resistance of the soil to water percolation.

2. Upstream slope protection must be provided by rip-rap stone from the top of the dam to 5 ft. below the lowest expected water level. Downstream slopes may be protected with stone, shrubs or vines.

3. Freeboard or the vertical distance from the water surface level to the top of the dam must consider high water levels and frost penetration.

4. Top width is calculated according to the formula

$$W = \sqrt{H} + 3$$

and where a road is to be placed on top of the dam, 2 ft. is added to each side of the road width.

5. MASONRY DAMS

a. Gravity dams receive name from the fact that the weight of the structure plus the weight of the water is sufficient to resist forces acting to overturn, shear, or slide the structure.

b. Forces which act on dams include: Water pressure, weight of dam and superimposed water (resulting in foundation reaction), flotation and uplift, erosion, ice pressure, earthquake shocks, wind pressure and wave pressure.

6. SPILLWAY

a. The function of spillways is to provide safe passage for water from above to below the dam.

b. For proper design the maximum discharge capacity must be calculated to serve the maximum discharge rate of the reservoir.

c. Types of spillways.

1. Uncontrolled — overflow, chute or side channel.

2. Automatic—siphon, shaft, flash boards and float-controlled gate.

3. Manual—outlet works, gates or valves.

C. . . . Floods

1. CONTROL PROVISIONS

a. Reservoirs can't hold all runoff. Must provide for wasting excess water at the dam without damage, especially earth dams.

b. Flood characteristics and relation to design.

1. Magnitude and frequency studies based on long term records can be plotted on probability paper to obtain a straight line. This line can be projected to cover any period up to 100 or 200 years. Flood control works are usually designed for flood stages which may be exceeded only once in 20 years.

2. Physical evidences of high flood levels are less reliable for determining conditions which must be met by flood control provisions.

3. In the absence of magnitude and frequency studies, drainage area characteristics are helpful to flood control design. Rainfall records, impervious soils and steep slopes, shape, size and other factors (wet ground, for example) affect maximum flow.

4. Compare drainage area of a basin to that of a known basin on which the U. S. Geological Survey publishes records of flows in its *Water Supply Papers.*

2. FLOOD ROUTING

a. Control of flood flow through a reservoir is a matter of operation. For this purpose the engineer finds useful such data as (1) the rise in surface elevation with respect to time, (2) surface rise in relation to storage capacity and to outflow capacity.

b. From careful study of such data, calculations can be made to indicate control procedures (routing) necessary to prevent cresting at an inopportune time.

D. . . . Reference Material

Source material used in this lecture includes these texts, in addition to several published articles.

"Water Supply Engineering" by Babbitt and Doland (McGraw-Hill)
"Water Supply and Sewage" by Ernest Steel (McGraw-Hill)
"Water Quality and Treatment"—American Water Works Assn.

For detailed discussion of various topics presented in this lecture see these and other texts on the subject.

Next Lecture

SOURCE OF SUPPLY—Part 4, WELLS

N.Y. Section A.W.W.A. Meets at Lake Placid

Adirondack Mountain Resort is Host at Association's Fall Meeting

THE famed Lake Placid Club, in its Adirondack Mountain setting, was so attractive a location for the fall meeting of the New York Section, A.W.W.A., on September 9 to 11, 1953, that 375 members and guests attended. Facilities of this club are extensive; not only does it provide a theatre for the technical sessions, but there are golf, tennis, boating, swimming, and tours of the grounds for social periods.

At the luncheon on the first day, Dr. Geo. C. Owens, Mayor of Lake Placid, gave an address of welcome. The GE color motion picture "Deep Water" was shown at the end of the first technical session.

The Water and Sewage Works Manufacturers Association was host at the cocktail hour held at the club Golf House, and also at the social hour following the evening banquet.

Faust Banquet Speaker

Mr. R. J. Faust, Executive Assistant Secretary, A.W.W.A., New York, N.Y., discussed a number of items of association interest. He described the status of Federal mobilization, transferring the Water Resources Division of the N.P.A. to the Dept. of Commerce where a Water and Sewage Industry and Utilities Division has been organized. Reports for critical materials are assigned to the Dept. of Health, Education and Welfare.

The A.W.W.A. has its research program under way, and has requested federal aid to investigate the problem of decreased water main carrying capacity when treatment processes are changed. At Michigan State College, studies are being made relating to the toxicity of chromium and cadmium in water. The association is endeavoring to find additional research projects.

A hunters' style breakfast started the final day of the meeting, and was followed by a round table conference devoted to consideration of water works problems.

At the business meeting, John M. Diven, membership committee chairman reported steady growth of the New York Association—to its present membership of 755.

Officers

Chairman	Vice-Chmn.	Past-Chmn.	Secy.-Treas.
Thomas B. Tyldesley Superintendent Water Dept. Watertown	S. P. Carman Cons. Engr. Binghamton	John G. Copley Gen. Mgr. Water Board Elmira	Kimball Blanchard Dist. Mgr. Rensselaer Valve Co. New York

The 1954 winter meeting, in New York City, will be held on January 19. The fall meeting is planned for Montauk Manor, Long Island, next September 9 and 10.

Technical Sessions

"DIATOMACEOUS EARTH FILTERS" was the subject of two papers which opened the technical program.

A.W.W.A. Director
James C. Harding
Commissioner
County Pub. Wks. Dept.
White Plains

Guest Speaker
Raymond J. Faust
Exec. Asst. Secy.
A.W.W.A.
New York

Diatomite Filters for Municipal Water Supplies

JAMES K. FRASER, Civil Engineer, Barker and Wheeler, Consulting Engrs., Albany, N.Y., presented an evaluation of diatomite filters for the treatment of municipal water supplies —with particular reference to installation of these units at Tupper Lake and Willsboro (communities located near Lake Placid).

He described the characteristics and commercial processing of diatoms to provide the filter medium. Filtering elements, which support the diatomaceous earth, may be wire wound plastic or steel cores, screen mesh cylinders, sintered brass or sintered stone. The slurry of diatomaceous earth and water, first applied to coat the filtering element, is termed a precoat.

In the filtration step, water passes through minute spaces in the precoat —without building up a gelatinous film. Small quantities of diatomaceous earth are continuously applied with the water in order to prevent plugging of the precoat; this results in a gradual increase in thickness of the coating on the filtering element. Eventually, backwashing of the units is necessary.

Generally, diatomite filters utilize a steel shell divided into two compartments, the filtering elements being supported by a plate located between the compartments. In such a design, approximately 153 sq. ft. of filtering surface may be provided in a unit having a diameter of about 2.5 feet, and thus requiring a relatively small amount of floor space.

Diatomaceous earth filters were selected for the installation at Tupper Lake, which has a population of 7,000 and is a commercial and resort center. The two gravity sources of water supply are inadequate for peak requirements, and it was decided that additional water could best be obtained from the lake. While slow sand and rapid sand filtration was considered, these were more costly than a diatomaceous earth installation

Programmers

James K. Fraser
Civil Engr.
Barker & Wheeler
Albany

Gilbert V. Levin
Pub. Health Engr.
P. H. Engrs. Bureau
Washington, D. C.

Alan W. Ross
President
Layne-New York Co.
New York

Frank D. Behan
Superintendent
Water & Sewage
Plattsburg

—and the latter type could more readily be stopped and started as an auxiliary supply.

An 800-ft. Intake Line

A 14-in. diameter mechanical joint, cement mortar lined, C.I. intake line was installed on the bottom of the lake, extending 800 feet offshore and taking water from a depth of about 33 feet (10 feet above the lake bottom). This line was placed during February by cutting a slot in the ice and pulling the pipe, assembled on shore, beneath the ice by means of a winch truck located about 300 feet beyond the offshore end of the intake. The pipe was kept full of air and additional buoyancy was provided by 55-gal. oil drums attached at calculated points along the pipe. This work was done in about nine working hours over a three-day period.

Water is picked up by deep-well, turbine type pumps and forced through four diatomaceous earth filter units. At a 2 gal. per sq. ft. per min. rate, these provide a capacity of 1.75 mgd. Prechlorination by means of gaseous chlorine is a part of the treatment process. The pumping station and filter building is only 29 ft. by 45 ft. over-all. A photograph of the interior of the station is shown here.

The entire cost of land, intake, building, pumping and filter building, and filter equipment was under $125,000. This plant can be put into full operation within a few minutes and provides water at full capacity immediately. The maximum run before backwashing is 87 hours, with the average requirement of filter aid being 300 to 400 pounds per mg.

A smaller diatomaceous earth filter plant was described, that installed at Willsboro, drawing water from Lake Champlain, to serve a community of 900. This plant provides two pumping units of the same type as at Tupper Lake, and a single diatomite filter unit (though plans include a second unit for future installation).

The intake is 8-in. C.I. pipe, and the water is pumped 8,000 feet through a transmission line of 6-in. asbestos cement pipe. The distribution system includes four miles of 6, 8, and 10-in. mains and a 200,000 gal. steel storage tank. The entire plant and system cost about $185,000 to construct.

Mr. Fraser noted that transportation costs make diatomaceous earth in the East rather expensive (most of this material is mined and processed in California). Not only is the cost 6 to 7 cents per pound but, during the past year, it has been in short supply.

He described, as a possible substitute, a natural form of calcium silicate known as Wollastonite. The only known deposit of commercial importance (estimated at 15 million tons) is located near Willsboro. This material has been used in the ceramic industry. If experiments with its use in the Willsboro filter are successful, the operating costs would be considerably reduced.

Diatomite Filters for Swimming Pools

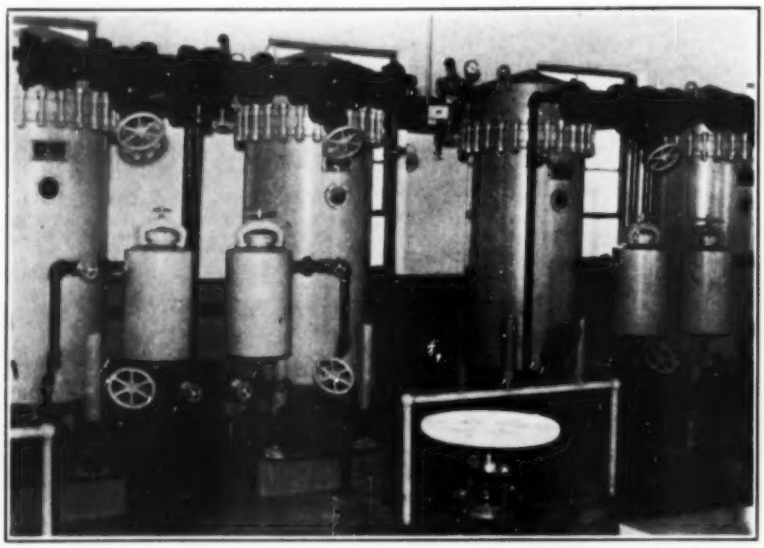
Gilbert V. Levin, Public Health Engr., Bureau of Pub. Health Engrs., Washington, D.C., reviewed experience with the application of diatomite filters to swimming pool water (the six indoor and outdoor pools located in Washington). He enlarged upon the details reported at the meeting of the Maryland-Delaware association last spring. For a review, see page 316 of our August issue.

These filter units are older types. Considerable corrosion of Monel wire core windings was found at one large outdoor pool—in three units, the windings of 100 out of 300 elements failed in the second year of use. Pinpoint corrosion occurred where wire was in contact with the plastic core. See photograph illustrating the appearance of a failed core.

In addition to reaction of wire and core, oxygen released by pressure, chlorine, and vibration were also potential causes of damage. In addition, built-in problems were found: filter heads could not be removed for inspection because the close ceiling slab had been poured after installing the filters!

A second installation of the same construction (Monel wire on plastic cores) was found to be in the same condition. Wire mesh elements at another pool were completely clogged.

Mr. Levin recommended more rugged construction, seasonal inspection (to assure backwash efficiency), and the use of higher rates of backwash or perhaps an "air-bump" for



Proportioneers, Inc. Photo

TUPPER LAKE, N. Y.—installation of diatomite filters

This is the compact but highly accessible installation described by Mr. Fraser. Capacity of the four units is 1.75 mgd.

assurance in cleaning units. He emphasized that swimming pool water is a more severe load on diatomite filters than the usual raw water, especially because grease penetrates the diatomaceous earth and results in adhesion.

To cure the troubles encountered, he advised design of filter installations specifically for the pools served, rigid specifications for purchase of units, minimum use of dissimilar metals, and yearly inspection. Under consideration is a "tray filter" unit which may solve many problems. This he described as similar to a pressure sand filter: three trays are located around a concentric pipe, and each supports a 1-in. layer of sand and a ¼-in. layer of diatomaceous earth.

CHAS. R. COX, Chief, Bureau of Water, State Health Dept., Albany, commented on the construction of filter support elements. There are four municipal installations of diatomite filters in New York State, and all employ earthenware elements. Bacterial removal is good—in this, the diatomite filters may be compared with slow sand filters.

CHAS. S. MANERI, Asst. San. Engr., State Health Dept., Albany, described a two-year-old installation at Cherry Valley, where filter runs average 48 hours. Diatomite filtration reduces the turbidity from a value of 5 ppm in the raw water to 0.2 in the filtered, and color reduction is from 10 to 6 ppm.

Deep Well Centrifugals

"DEEP WELL PUMPS" was the title of a paper presented by Alan W. Ross, President, Layne-New York Co., Inc., New York, N.Y. (Mr. A. O. Fabrin, Chief Engineer of the company prepared the paper.)

There was a close association between the early history of both centrifugal pumps and steam engines. By the year 1900, there was not a deep well pump of the centrifugal type in use. Shortly thereafter, engineers found that with sufficient speed centrifugal pumps could operate against high head pressure.

Behavior under actual operating conditions was cited as the best evidence of pump performance. Within less than 45 years—and especially during the last 20 years—great improvements have been made in centrifugal pump design and operation.

Deep well centrifugal pumps utilize higher velocity than the usual horizontal centrifugal pumps and, as a result, require special design considerations. Much research has been required to produce the present high standard of performance from this, a relatively simple machine.

Chas. R. Cox
Chief, Water Section
State Dept. Health
Albany

George E. Symons
Consultant and
Tech. Editor
Larchmont

R. G. Yaxley
Superintendent
Water Commrs.
Waterford

Laurence J. Griswold
Prin. Engr.
Water Supply Board
Utica

Round Table

Round Table

Leader of the round table conference on water works problems was FRANK D. BEHAN, Supt. of Water and Sewage, Plattsburg. Four topics appeared to be of particular interest to members.

"THE RIGHTS OF WATER MAINS" is of present concern in many parts of the state, as the highway construction program creates ever-growing problems.

LEROY EBRIGHT, Supt. Westbury Water District, said that the highway officials appear to hold all power. There is no specific plan on Long Island for the disposition of water and sewage utility lines, and municipal utilities are seldom set up to finance the cost of moving lines.

ANGUS HENDERSON, Civ. Engr., Dept. of Water Supply, New York City, reviewed state legislation proposed to include the costs of changing utilities in general contracts for highway construction. This would make it mandatory for the State to reimburse publicly—but not privately—owned utilities for expenses: the legislation has not been approved. He mentioned that, as a special case, the New York State Throughway construction does include costs of relocating utilities.

MR. FAUST mentioned the active part played by Harry Jordan, representing the A.W.W.A. in Federal hearings on the subject. A survey of 12 representative states has shown the expense involved to be about 3 per cent of the total construction costs. A bill is presently before a Congressional committee to require payment of up to 50 per cent of all utility expenses resulting from highway construction.

ELEMENT from swimming pool filter
Monel wire spalls from plastic element. Pin point corrosion was cause said Mr. Levin.

Street Excavation Regulations

THOS. B. TYLDSLEY, Supt., Water Dept., Watertown, reported on the new 1953 New York state law requiring 72 hours notice *in writing* where excavations are to be made in the vicinity of combustible gas lines. He recommended that all water utility authorities should request their state representatives to regularly provide copies of bills which apply to utilities.

LAURENCE J. GRISWOLD, Prin. Engr., Board of Water Supply, Utica, stated that the local gas utility does not consider it necessary to follow the letter of the law. The water utility does provide a report of such excavations by telephone to keep the gas company advised. He decried the increase in paper work involved, and suggested that an amendment to the law might be made with the consent of gas utilities.

A speaker for the New York Water Service Company, Long Island, reported its practice to be the making of an extra print of the proposed work for, and giving the estimated date to, the gas utility. The law is found helpful, because it assigns to the gas utility the responsibility of notifying as to the location of the gas mains.

OUTDOORS—cocktail hour

From Utica: Stuart Andrews, Monarch Chem. Co.; George Bannigan, Commr., and Leo Aiello, Engr., Board of Water Supply. From Larchmont: Mrs. Symons and "Doc". From Ithaca: F. R. Georgia, Supervisor, Cornell Univ. Filter Plant, with his guests Terry Nesslinger and Meg Stewart.

Chemical Feed Equipment

"CURRENT DEVELOPMENTS IN CHEMICAL FEED EQUIPMENT" were described by George E. Symons, Consultant and Technical Editor, Larchmont, in a summary covering dry feeders, solution feeders, and gas feeders.

The equipment offered by all manufacturers tends to provide greater accuracy, lower cost, and a decrease in the size of many models; at the Grand Rapids meeting, for example, a smaller loss-in-weight type of feeder was exhibited. With the special use of fluoride feeding in mind, a small disc type unit has been made available. For use with a lime slaker, there is now offered a sentinel alarm designed to provide a warning in the event that the flow of water is stopped.

"Doc" Symons described the newest development as the "massometer," a device relating air pressure to the discharge of solids on a revolving disc.

In the application of activated silica, one manufacturer offers a "silactor" to react sodium silicate solution and gaseous chlorine; while another has produced a detention tank unit permitting the use of any activating agent with the silicate solution. Each of these combination feeders provides for the continuous preparation of the coagulant aid.

Questions and Answers

"YOUR QUESTIONS," the final round table topic, brought out discussion relating to a number of subjects.

CHAS. R. COX reviewed the amendment to chapter 5 of the N.Y. State Sanitary Code, recently approved by the Public Health Council. The amendment now defines a public water supply as one serving as few as five houses. There is a provision requiring treatment for protection against actual or potential pollution, and machinery is set up for handling emergencies.

Mr. Cox urged the formation of more local sections in the New York association, to enable the active participation of water works men from only one or two counties meeting monthly.

He gave details of a newly available material, ammonium silicofluoride. This is very soluble, a 10% solution requiring 0.8 pound of chemical per gallon of water; and 13% solutions can be prepared. The form available is granular and no dust problem exists. However, the ammonium ion may complicate the chlorination treatment of water.

FRED WELCH, Engr. Nassau County Dept. of Public Works, reviewed the ground water contamination problem created on Long Island in an area which includes many aircraft manufacturing plants (see article by Messrs. Davids and Lieber in *Water and Sewage Works*, December 1951). The installation of industrial waste treatment plants for treatment of chromium removal has kept the problem under control. Continued examination of wells in widening areas revealed no phenols, but did result in condemnation of water on a bacteriological basis.

R. G. YAXLEY, Supt., Water Commrs., Waterford, recommended the routine inspection of valve boxes —at least twice yearly. While little time is required for this procedure, it is important in an emergency to know immediately where valves are located and in which direction the stem should be turned.

EDWARD M. GRIFFIN, Supt., Johnson City Water Dept., added to Mr. Yaxley's recommendation by citing the value of an inspection program for main-line valves. Only two weeks after completing such a program at Johnson City, and getting all valves in working order, a main break occurred and demonstrated the value of having everything in working order.

INDOORS—banquet and social hour

"Alex" Cameron Dies in Florida

Alexander B. Cameron, retired superintendent of the Jackson, Mich., sewage treatment plant died in Miami, Fla., on October 5th. He was 59 years old and retired.

"Alex" Cameron was one of the country's most proficient sewage works operators. The plant at Jackson was noted for a remarkable rec-nected with the desigr and construction of the Jackson activated sludge plant and thereafter became superintendent, which position he held from 1936 until his retirement in 1948 as the result of a heart attack.

A native of Torch Lake, Mich., "Alex" Cameron had previously been superintendent and chemist at the treatment plants of Fostoria, Ohio, Erie, Pa. and Springfield, Ohio. He was a recognized leader in the Michigan Sewage & Industrial Wastes Assn. and was nationally known for his abilities as a chemist and plant manager. Upon his retirement he was succeeded by Robert A. Green, former chemist at the Jackson plant, who has as much difficulty explaining why this plant performs day in and out as it does at such low-operating costs for an activated sludge plant at which many process improvements have been put into effect.

Mr. Cameron was a Mason and is survived by his widow and one daughter.

SEWAGE WORKS PRACTICES

OPERATION • MAINTENANCE • MANAGEMENT

Screening and Shredding Units and Disposal of Screenings

The Sixth of a Series

by DON E. BLOODGOOD, *Professor of Sanitary Engineering*
Purdue University, Lafayette, Ind.

In this series, Professor Bloodgood discusses *Sewage Works Practices* in the form of simple short course lectures. Each article is designed to interest and assist plant operators, students, and all who wish to review fundaments in this field.

The Editors

THE two general divisions or classifications of sewage treatment processes are *primary treatment* and *secondary treatment*. Usually a plant providing secondary treatment includes all the equipment found in primary treatment plants and, in addition, activated sludge or trickling filter units.

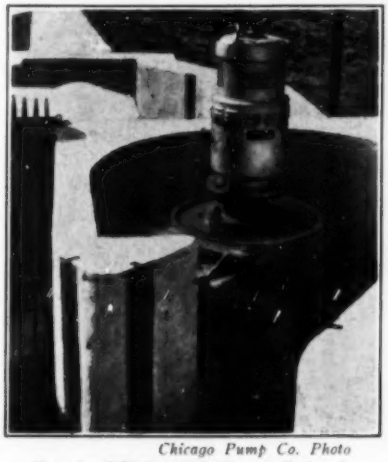
In the previous discussion of solids in sewage, the importance of suspended matter in the treatment process was pointed out. It was emphasized that the main principle of sewage treatment is the separation of solids from the water. No particular attention was paid, in the discussion of solids, to their size or relative weight.

Suspended solids may vary greatly in size. Some of them are so small that single particles cannot be seen without a magnifying glass; these are called *colloidal* solids. The largest of the suspended solids, those that can be removed by a screen having large openings, are called *screenings*. This term has been applied to the larger materials found in sewage regardless of whether or not they are removed from the sewage by a screen.

Purpose of Screening

Many individuals not acquainted with sewage and sewage treatment believe that, when sewage is screened the material passing through the screen has become relatively pure. As a matter of fact, however, the removal of sewage solids by a screen having a mesh as fine as window screening would not remove significant percentage of the solids in sewage. There are today only a few sewage plants in the United States that use fine mesh screens to remove solids. The reason why fine screens are not used more widely is that they cost too much for the amount of purification they can do.

You will now want to know why almost every plant does have screens, bar racks, or some other method of removing the large sizes of solids from sewage. It can safely be said that the removal of screenings on coarse bar racks is done for some purpose other than to remove the suspended solids from sewage. The devices are used nowadays to separate or shred those solids that would cause trouble or damage in later treatment processes of a sewage plant.



Chicago Pump Co. Photo

Fig. 1—COMMINUTOR installed adjacent to hand raked bar screen at the Lebanon, Pa., sewage plant for shredding screenings.

Composition of Screenings

There is no way to adequately describe the composition of screenings: They are made up of every conceivable material and there is nothing in the world that they can be compared with. It is safe to say that any known object might be found in screenings, even though the item is so small that it could not be retained on the screen or bar rack unless it is caught in some other debris.

Some of the more unusual materials observed in screenings are railroad ties, scoop shovels, heads of butchered hogs, and money. The writer does not claim to have found any of the last named commodity and can only report on hearsay in this regard. It is not easy to imagine how some of the unusual materials get into sewers, but they often are found.

There is some fecal matter found in screenings, but it is not the major constituent. Certain materials are found seasonally as coarse screenings. In the fall of the year, great quantities of leaves find their way into the sewers; especially where a combined sewer system is used, and in that part of the country where trees shed their leaves. Screens or bar racks are useful in catching waste materials that sometime escape the pre-treatment processes of canning plants operating on a seasonal basis.

One of the most troublesome of materials that would get into sewage treatment units if it were not for the screenings, are rags and pieces of string. Rags and string enter sewage by way of household fixtures, and consequently the quantity of such materials found in sewage does not depend on whether or not the sewage

system is of the combined or separate type.

Until recently, when pretreatment of packing plant wastes became almost universally adopted, large quantities of offal and other materials from this source would be found on the coarse bar racks of a sewage plant. These were found to be particularly troublesome in treatment processes, not only because the material wound around shafts and clogged pipes and pumps, but also because very objectionable odors arose when the material decomposed.

From the illustrations given of the several kinds of screenings, it can be seen that they are largely organic in composition; some of them are of plant origin and some are from animals. Certain materials are readily decomposed and others are very resistant to bacterial decomposition. Some are odorous in themselves and some take up objectionable odors from the sewage.

The sewage plant operator who has had to remove twisted rags from the impeller of a sewage pump will vouch for the need to keep screening devices continuously in service. That operator who has had to empty primary tanks in order to remove a block of wood which has jammed the mechanism—and perhaps broken a flight or two—will vouch for the need of proper screening at all times. Then there are other problems that arise when materials such as rags get into digestion tanks, become lodged on the heating coils and cut down on the rate of heat transfer, preventable only by proper screening.

Screening Devices

There are two general classifications of screening devices in use today: coarse bar racks and shredding devices. The shredding devices cut up the screenings without removal from the sewage flow (See Fig. 1).

Coarse Bar Screens

The openings in coarse screens usually are five-eighths of an inch to two inches wide for mechanically cleaned screens, and from one to two inches wide for hand raked screens. From this it may be deduced that materials which can pass a two inch opening do not give particular trouble in pumps or other equipment.

Some may wonder why the minimum size of five-eighths of an inch is allowed for mechanically cleaned racks and a minimum of one inch allowed for hand raked racks. The best reason that can be offered is that with continual cleaning by mechanical devices the rack spaces are usable to the fullest extent all of the time.

While the finer spacings between openings will take out more materials, it is questionable whether the removal of the smaller particles materially reduces the troubles caused by this type of material. Furthermore, the added solids removal accomplished by finer screening does not materially aid in the overall solids removal from the sewage.

An operator having racks with two-inch bar spacings and experiencing difficulty with large pieces of solids in his equipment, should consider the advisability of decreasing the spacings; but he must realize that when such a change is made there will be some increase in the quantity of screenings to be disposed of.

One of the best questions to put to a young sanitary engineer to learn whether or not he is a thinker, is to ask him why coarse bar racks are slanting. Some of the answers given are, of course, surprising—and not many can suggest the main reasons. The reason that is very obvious to anyone who ever has tried to clean a vertical rack in a stream of sewage is the greater ease of cleaning a sloping rack. The sloping rack also provides a greater area on which the screenings can be deposited so that it is not necessary to rake it quite as often for cleaning.

The channel in which screening devices are located should be so designed that the minimum flowing through velocity is one foot per second. A plant operator may not design the channels but he may be confronted with the problem of removing grit from in front of his particular screening device if the velocity in the channel becomes less than one foot per second. When grit deposits occur ahead of screens the operator should take steps to decrease the cross sectional area of the screen channel.

Shredding Devices

The shredding devices such as the Comminutor cut up screenings in sewage to a size that will not give trouble in other parts of the plant. The equip-

Chain Belt Co. Photo

Fig. 2—INSTALLATION at Highland Park, N.J.—Rex mechanically cleaned bar screen
Automatic controls are (left to right) magnetic starter, "day" time clock, pilot switch for "day" and "night" time clocks, "night" time clock.

ment is not in any sense of the word a solids removal device. But neither does the mechanically raked or hand raked rack remove solids—when the screenings from sewage are shredded, and put back into the sewage to be again removed by other processes in the treatment plant.

Some advocates of the philosophy, "The purpose of sewage treatment is solids removal, and solids once removed should never be put back into the sewage to be removed a second time" have never been confronted with the problem of *what* to do with the screenings removed. These statements are not made with the intent to give a preference for either of the two methods of screening. The statements made are to indicate to the operator that there are advantages and perhaps disadvantages to both types.

Where there are mechanically equipped devices, the hand raked rack should be kept in readiness for operation. In an emergency it can be used to properly protect the equipment in other parts of the plant.

Operation of Screening Devices

Some facts regarding the operation of screening devices have been included in describing the devices. There are other operating suggestions, however, that should be mentioned.

It has been pointed out that the concentration of screenings may be quite variable. The times of heavier concentration need to be carefully noted by the plant operator, so that he does not plan to make major repairs to his screening devices at such times.

All mechanical equipment will need attention, and wear will normally occur. Wear proceeds at a rather uniform rate so that an operator should, by careful inspection, be able to foresee when it will be necessary to make repairs.

Some mechanical screens and shredders have timing devices so that these units operate only at intervals (See Fig. 2). In general it can be said that shortening the running time of a machine will increase the length of life of the wearing parts and the cost of operation will be less. However, this policy can be carried too far, since a lengthened "down time" may result in an overload on the equipment when it is started. Attention should be given to the time of operation of each particular unit. The manufacturers of equipment are usually very glad to give advice on setting the timing devices of their equipment.

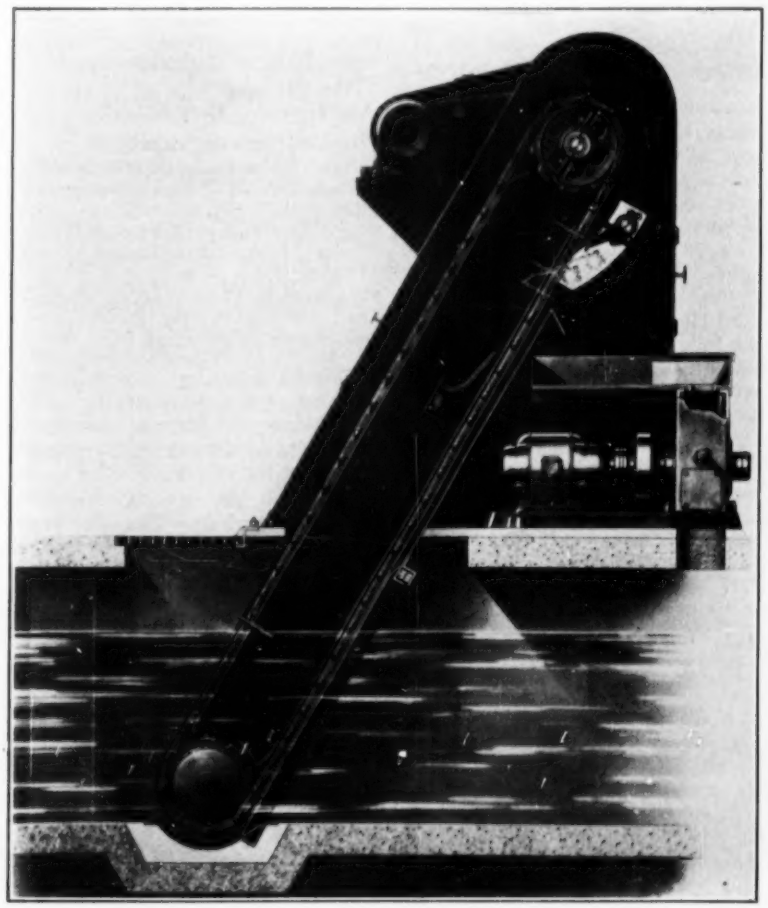
In plants equipped with multiple screening devices it is important to determine whether it is necessary to operate all units during the entire day or at intervals during a day. Remember that decreased running time saves wear, unless the "down" periods are long enough to permit rusting or other corrosion of parts.

Disposal of Screenings

In screening devices where the screenings are shredded as they pass through (or where the screenings are removed, ground, and discharged back into the sewage), the screenings are later removed in the primary settling tanks (See Fig. 3). These screenings become primary sludge that is disposed of in the conventional manner, by digestion or by filtration and incineration. Screenings are largely organic in nature, and much of the organic matter will be decomposed in sludge digestion tanks. Where primary sludge is vacuum filtered and then burned, the shredded screenings are readily destroyed in incinerators.

In some plants it is the policy to incinerate screenings. Screenings as removed are water soaked, and must be thoroughly drained before they are burned. Though screenings are largely composed of organic matter, and thus have fuel value, it usually requires more heat to drive off sufficient moisture so that they will burn than there is fuel value in the screenings. Where a sewage plant would burn gas in the waste gas burner, if not used in burning screenings, the saving of fuel is not important. In some larger treatment plants, screenings are de-watered in centrifuges or in presses, prior to incineration, in order to save fuel.

Many sewage plant operators dispose of screenings by burying. Such a practice is not a burden in small plants because the quantity of screenings is so small. Where this is done the screenings are allowed to drain as they are removed from the racks, and then are deposited in covered cans that are emptied each day. The screenings should be covered with several inches of dirt or washed grit as they are deposited each day, so as to prevent attracting flies and rodents.



Chain Belt Co. Photo

Fig. 3—DIAGRAMMATIC arrangement of Rex sewage screen and screening shredder Screenings are elevated to the shredding device, are ground and returned to the sewage channel below.

Eventually the buried screenings should be covered with enough dirt so that rats will not burrow down to them.

Tests of Screenings

The small plant operator will have no particular need to make laboratory tests on coarse screenings. He can be thankful for this because screenings are objectionable to handle and hard to sample.

If screenings are being incinerated and fuel cost is an item, it will be desirable to keep the moisture content of the screenings as low as possible. To make sure that the lowest reasonable moisture content is being maintained it may be desirable to run moisture determinations.

This can be done by collecting a representative sample, weighing out 200 to 500 grams in a shallow pan, obtaining the weight of the wet screenings on a trip scale, drying the screenings first on a steam bath and finally in a drying oven, and then obtaining the weight of the dried screenings. The difference in weight between the wet and dry screenings, divided by the weight of the wet screenings, and multiplied by 100 will give the percentage moisture in the screenings.

If the fuel value of the screenings must be known, the Btu value can be determined if extreme care is used in selecting the proper size of dried screenings sample. The test is made in a special laboratory device known as a bomb calorimeter, such as is used to determine the fuel value of coal.

Summary

The proper operation of screening devices is a very important part of the responsibility of an operator.

Well operated screening devices prevent serious damage and interruption to many units of a sewage treatment plant.

The operation of screening and shredding devices for a minimum of time may save wear and power, but an over-zealous desire to cut down on operation time may result in harm to the devices due to corrosion.

Screenings must be disposed of in a manner to prevent nuisances from flies, rats, and odors.

South Dakota Water and Sewage Works Conference

Holds 19th Annual Meeting in Rapid City*

The 19th Annual Meeting of the South Dakota Water and Sewage Works Conference was held in Rapid City, S.D., Sept. 22-24, 1953. The registration was 121 from 45 municipalities.

Following the custom of the Conference, the first half day of technical sessions was devoted to papers of interest to both water and sewage works operators. Mr. W. Jones, Allison-Williams Co., Minneapolis, Minn., discussed water and sewage works financing with particular emphasis devoted to legal procedures in South Dakota. This presentation was followed by a panel discussion dealing with the Voluntary Certification of Water and Sewage Works Operators.

The afternoon sessions of the first day were divided into two sectional meetings:

WATER SECTION

"Use and Care of Centrifugal Pumps"—L. H. Kessler, Chief Hydraulic Engineer, Fairbanks-Morse Co., Chicago

"Rapid City Water Works and Swimming Pool"—L. P. Steiling, Rapid City Water Works Superintendent

Open Forum for Operators

SEWAGE SECTION

"Waste Treatment Facilities"—Gerald A. Munson, Lithium Corp. of America, Hill City

"Rapid City Sewage Treatment Plant"—Charles Price, Superintendent Sewage Treatment Plant

"Treatment of Plane Washing Wastes"—Charl Berry, Ellsworth Airforce Base

Open Forum for Operators

On the following morning there were inspection trips of the Rapid City Water Works, the completely rebuilt Rapid City sewage treatment plant, and the new Rapid City Swimming Pool. An optional inspection trip was provided on Thursday afternoon, with a visit to the interior of the Black Hills at Hill City, South Dakota and the Lithium Corp. of America plant.

At the banquet the annual $50.00 Flox Award was won by Mr. Don Wessel of Mobridge. The second annual Izaak Walton League Award went to Mr. Clarence Shaul, Superintendent of Sewage Works at Hot Springs. The newly established Longevity Award Committee, presented certificates to 16 water and/or sewage works operators in South Dakota who have served their communities in this capacity for twenty years or more. W. P. Wells received the Conference Attendance Prize.

The following officers were elected: President—Don Wessel, Mobridge; Vice-President—Siger Bies, Aberdeen; Directors: G. J. Gunderson, Madison; Clarence Shaul, Hot Springs; William Mailloux, Sturgis; Jacob Murschel, Webster; H. A. Fowler, Vermillion; Bill Campbell, Jr. of Flandreau, representing industry. C. E. Carl, Pierre, was re-elected Secy.-Treas.

*Excerpts from a report by C. E. Carl, Secy-Treas. of the Conference and State Sanitary Engr. of South Dakota.

Officers 1953-54

Front Row: Jacob Murschel, Webster; G. J. Gunderson, Madison; Wm. Mailloux, Sturgis; President Don Wessel, Mowbridge. Rear Row: W. V. Campbell, Flandreau; H. A. Fowler, Vermillion; Vice-Pres., Siger Bies, Aberdeen; Sec'y-Treas. Chas. E. Carl, Pierre.

Prize Winner

W. P. Wells, of Aberdeen, S.D., receiving the Conference Attendance Award—a handsome wrist watch—from President Don Wessel.

Tenure of Service Awardees

Front Row: Al Ross, Huron; Gunder Nelson, Pierre; Chas. Clark, Mitchell; Siger Bies, Aberdeen. Rear Row: A. T. Hanson, Sioux Falls; G. J. Gunderson, Madison; Rhea Rees, Sioux Falls; Lyle Meadows, Watertown.

Recovery of Polluted Streams

Purification Capacity of a Stream can be Determined and Used to Forecast the Effect of Pollution

by C. J. VELZ, School of Public Health, Univ. of Michigan, Ann Arbor, Mich.

MATURITY in human endeavor is measured by the success with which we are able to anticipate or forecast the outcome or consequence of any plan of action. Through the application of engineering intelligence, industrial management has reached such a high level of maturity that large investments are made in almost complete confidence that products of predetermined quantity and quality will result. How is this? Such confidence stems from the fact that the approach is rational. Factors are quantitatively defined. Rigorous analyses precede design, construction and operation.

Professor Velz is Chairman of the Department of Public Health Statistics and Director of Stream Analysis Research, School of Public Health, Univ. of Michigan. This paper and the discussion which follows were presented at the 1953 Annual Meeting of the National Council for Stream Improvement (Pulp, Paper and Paperboard Industries Inc.) and have been released by the Council for publication in *Water & Sewage Works.*

Rational Use of Water Resources

In use and management of water resources, there is evidence that maturity has replaced irresponsible adolescence. This more rational approach requires—of governmental and industrial groups and all the people—that we be rational about our concept of conservation. Irrationally, some have held that conservation implies forbidding use. Non-use is total waste and is as much a loss as destructive overuse. Irrationally, others have held that first come, first served, and the devil take the hindmost. These would appropriate water resources for their exclusive use to the detriment of other uses. This is abuse. *The rational concept is balanced multiple use,* with the objective of fullest use over the years without waste or abuse.

An important water resource which should be neither abused nor wasted is the self-purification capacity of streams. Our stream analysis studies for the Council are aimed at the quantitative definition of this valuable asset so that it can be maturely considered in reaching rational decisions dealing with pollution abatement proposals and new mill locations or expansions. It may be helpful if I present a few of the fundamentals involved in the complex phenomenon of stream recovery. This will explain why we need certain types of basic data.

Nature of Self-Purification

There are so many facets to stream recovery or self-purification that, first, it may be well to briefly sketch the overall nature of the phenomenon in some familiar terms. Let us consider organic polluton which is of primary interest to the pulp and paper industry. The best single measure of organic pollution is the quantity of oxygen required to stabilize it by natural biological processes of decay —*the biochemical oxygen demand* (B.O.D.).

The oxygen required to satisfy the demand of unstable organic matter discharged into a water course is obtained from the oxygen dissolved in the river water. If the demand for oxygen is in excess of that available, the dissolved oxygen is exhausted and the stream goes into complete bankruptcy. Thus, the B.O.D. may be regarded as liabilities, outstanding debts, and the dissolved oxygen of the river water as assets. In order to evaluate the solvency or condition of the stream along its course, we must know how fast these organic debts are amortized and also we must know the amount of income from the asset sources. *Stream solvency* depends upon the balance between outgo and income.

The Asset Side

First let us examine the asset side of the ledger. What are the major sources of income and what are the factors which influence the amount of dissolved oxygen that we can expect in any reach of the river under different conditions? There are but two dependable sources of oxygen income to a stream: one source is the dissolved oxygen contained in the stream flow and any increments added from tributaries along the course, provided these tributaries themselves are not polluted; the other source is reaeration from the atmosphere.

The quantity of dissolved oxygen contributed by runoff depends upon the rate of stream flow. When the stream discharge is high the contribution is high; but during periods of low flow the contribution diminishes. The amount of dissolved oxygen contributed by runoff also depends upon temperature, as it controls the saturation level of the water exposed to the atmosphere. During the summer warm weather period the stream is capable of carrying at saturation only about one-half of the amount of dissolved oxygen it can carry during the cold winter season. Cash income from runoff, then, is least during warm weather drought periods.

The rate of oxygen income from reaeration is a highly variable and complex asset. The rate of income is dependent upon the amount of cash on hand; if the bank is full (water saturated), there is no income; if the oxygen is completely exhausted, the rate of income reaches its maximum; and between these extremes, rate is directly proportional to oxygen deficit below saturation. While oxygen deficit is the throttle which regulates the rate of income, the actual amount received from reaeration depends upon physical and hydraulic characteristics, water temperature, depth, occupied channel volume and stream turnover. Knowing these basic factors, reaeration for any particular stretch of river can readily be computed.*

Liability Side

Now let us examine the liability side of the ledger. Who carries on this business? What governs the normal amortization of debts? Are there any abnormal demands?

The Chain Gang. Nature supplies the labor force to carry out the opera-

* Sewage Works Journal, Vol. XIX, No. 4, July, 1947.

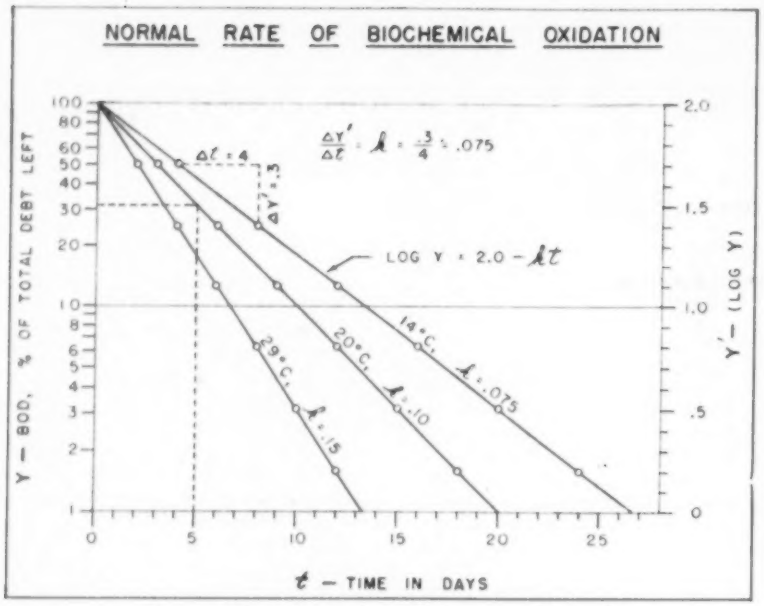


Fig. 1—RATE of biochemical oxidation on semi-log scale
The percent of total B.O.D. remaining is plotted against time in days.

tions of oxidizing unstable organics to stable mineralized forms. The process is a living biochemical reaction where the organic matter serves as a food supply for a complex chain of biological life, each group of organisms performing its allotted share of work in oxidation. As long as some dissolved oxygen remains in the stream this process is controlled predominantly by the aerobes who polish off the job in fine shape without any nuisance. If, however, the organic load is so great that dissolved oxygen is exhausted, the wrecking crew, the anaerobes, take over. The organics are oxidized, but the anaerobes—borrowing from Peter to pay Paul—take the necessary oxygen from previously stabilized matter such as SO_4 and in the process reduce it to H_2S. The result is a foul, putrescible ruin. The crux of the situation obviously is to keep the job in the hands of the aerobes.

Normal Amortization of Organic Debt

Amortization of the organic debt, or the rate of satisfaction of the biochemical oxygen demand, is really then a reflection of the rate at which the chain gang eats. As in so many natural phenomena, it is well known that this chain of life eats at a constant rate rather than a constant amount. This is probably part of wise Nature's scheme of survival. Eating at a constant rate always preserves some fraction of food for the lean days. It is also an economical way of dealing with an unusually large organic load in quickly bringing it down to stabilized form. The specific rate of eating is dependent upon the nature of the food supply and the temperature, increasing or decreasing with rise or fall in temperature.

Phelps Law. The phenomenon was first expressed in mathematical terms as Phelps' law: "the rate of biochemical oxidation is proportional to the remaining concentration of organic matter measured in terms of oxidizability."

Since many of you are chemists, it is well to point out that not all of the organic matter is available as biological food. "Measured in terms of oxidizability" recognizes an important distinction between complete chemical combustion of organic matter and stabilization by biological processes. We are not concerned here with

Table I
NORMAL BIOCHEMICAL OXIDATION
MIXED ORGANICS

% of Total BOD Left (1)	Time Required At 20° C (2)	At 29° C (3)	At 14° C (4)
100 %	0 Days	0 Days	0 Days
50	3	2	4
25	6	4	8
12.5	9	6	12
6.25	12	8	16
3.13	15	10	20
1.56	18	12	24
0.78	21	14	28

oxygen requirements of complete chemical combustion; we are concerned only with that portion of the organic matter which serves as oxidizable food supply to the chain gang of biological life, the B.O.D. fraction. This sounds complicated, but actually Nature's rule is quite simple: at any particular temperature the percentage of the total biochemical debt paid per interval of time is always a constant percentage of that remaining unpaid from the previous interval, as illustrated in Table 1.

It is evident that, for the mixed organics of municipal sewage and the majority of industrial wastes, 50 percent of the organic debt is amortized (eaten, oxidized) in 3 days at 20° C. and, in accordance with the basic law, one-half of what is left after 3 days is amortized in the next 3 days; and so on in succeeding 3-day intervals, with always some fraction remaining.

At first glance this looks like an easy payment plan with an infinite time before the complete debt must be paid. However, don't be fooled. Mother Nature is pretty sharp. A second examination reveals that the plan of amortization is decidedly unbalanced, requiring heavy payments on the debt in the early periods; one-half must be paid in the first 3 days, three-fourths in 6 days, seven-eights in 9 days, etc. The fraction of the total that can be postponed to that

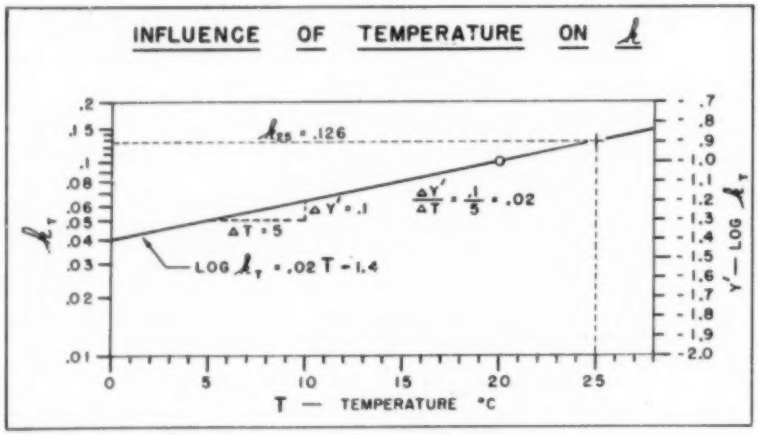


Fig. 2—RELATIONS of temperature to k value
Example (see dotted lines) shows k at 25° C. may be read directly from graph as 0.126.

long distant day is woefully small and we must be prepared with plenty of cash on hand for those first few days.

It will also be noted in Table 1 that as the temperature increases to 29° C. the amortization schedule shortens, each succeeding 50 per cent reduction in outstanding debt is accomplished in a 2-day time interval, with less than 1.0 per cent (0.78 per cent) outstanding at the end of 14 days. As the temperature decreases to 14° C. the amortization period, however, is lengthened, each succeeding 50 per cent reduction taking place in 4-day time interval, with less than 1.0 per cent (0.78 per cent) left outstanding at the end of 28 days.

If data of Table 1 are plotted on semi-log paper (the per cent of the total B.O.D. remaining against time in days) perfect straight lines develop, as shown on Fig. 1. Each straight line has a specific slope k dependent upon temperature. For example, at 20°C. the logarithmic rate of decline is measured by

$$\frac{\Delta y'}{\Delta t}, \text{ the slope}$$

$$\text{which is } \frac{0.3}{3.0} \text{ or } 0.10 = k$$

Similarly, at 14°C. the slope is measured by

$$\frac{0.3}{4.0} \text{ or } 0.75 = k$$

and, at 29°C. the slope is measured by

$$\frac{0.3}{2.0} \text{ or } 0.15 = k$$

The relationship of the slope k to temperature is illustrated in Fig. 2, from which k_T at any temperature is readily obtained. For example, k at 25° C. is read from the graph as 0.126.

Abnormalities Affecting Amortization Schedule

Under natural stream conditions, three abnormalities are encountered which affect Nature's otherwise quite normal straightforward amortization scredule as discussed above: immediate demand, sludge deposits, and occasionally biological extraction on the stream bed. If sewage or waste contains chemical products or end products of decomposition which are immediately capable of chemical reaction with the dissolved oxygen in the river water, an immediate demand may be exercised upon the stream assets without need of a time element in biological eating process. A portion of the debt is accordingly amortized immediately upon discharge into the stream thereby further increasing the drain on assets in the early stages of amortization.

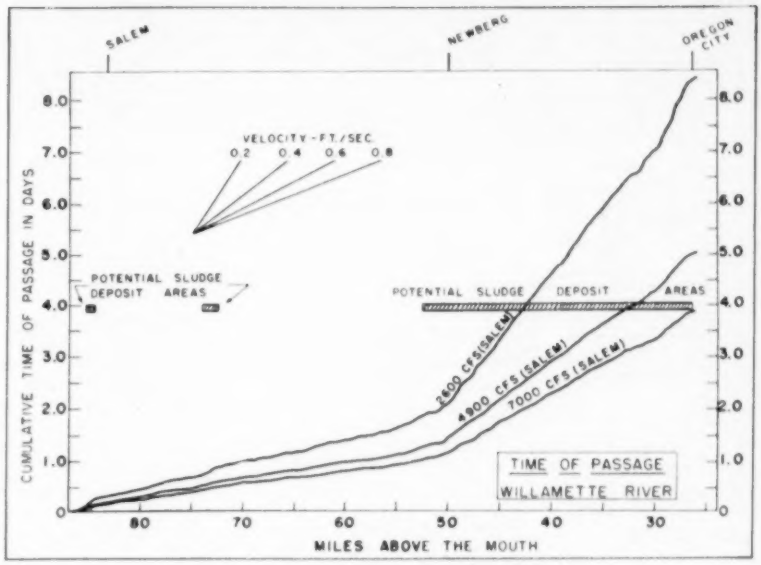


Fig. 3—CUMULATIVE time of passage curves
The relation between runoff rates and potential sludge deposit areas.

If the B.O.D. of sewage or waste contains a fraction in the form of settleable solids and if the stream velocities are sufficiently low (such as occurs in pool areas behind dams) the settleable solids fraction will deposit on the bottom of the river and, if not scoured by freshets, will accumulate. Food supply continues to accumulate until the amount eaten from the pile per day just balances the daily increment of fresh organics deposited. When this equilibrium is reached, the combined daily payment of debts from the accumulation is equivalent to paying in one day the total debt of what was deposited that day. This puts an excessive demand on the assets of the stream in the area of the deposits and greatly adds to the burden of amortization in the early stages.

In shallow streams where the mass of water in relation to surface area of the stream bed is small, the biological zooglosa attached to the bed has the facility of extracting and storing in its mass, organic food supply. As with sludge deposits, this extraction will build up to equilibrium storage such that the amount eaten per day from the accumulated storage just balances the daily amount extracted. This likewise places a very high burden on the oxygen resources of the stream in such a region. The phenomenon of biological extraction at times has been misinterpreted as unusually high rate of eating. Actually, this is not the case. The rate of eating is the same, but the demands on oxygen assets are higher because the eating is from an accumulated pile.

Channel Characteristics

At this point I should like to expand upon the importance of a detailed definition of the physical characteristics of the river channel along the course of the stream. In addition to providing the basic factors for computing cash income from reaeration, channel characteristics are essention in determining the all-important time of passage governing the cash outgo.

Occasionally excellent maps with channel soundings are available from private or governmental agencies, such as those which may be supplied by the Corps of Engineers. If such maps are not available, it is necessary to cross-section the stream. Time and expense of water course soundings is now greatly reduced by the adaptation of portable echo sound equipment which is capable of rapidly scanning and recording depths almost continuously from a traveling boat. With excellent soundings such as were at our disposal on the Willamette River, and aided by modern statistical computing machines, it is possible to determine quite accurately the time of passage by short increments along the course of the stream under a whole range of runoff regimes.

Fig. 3 shows the cumulative time of passage along the 60 mile course of the Willamette River from Salem progressively downstream to Willamette Falls. Each particular runoff regime produces its own curve, shortening time of passage at high runoffs and lengthening time at drought flows. Such curves also afford a basis for investigating the potentialities of sludge

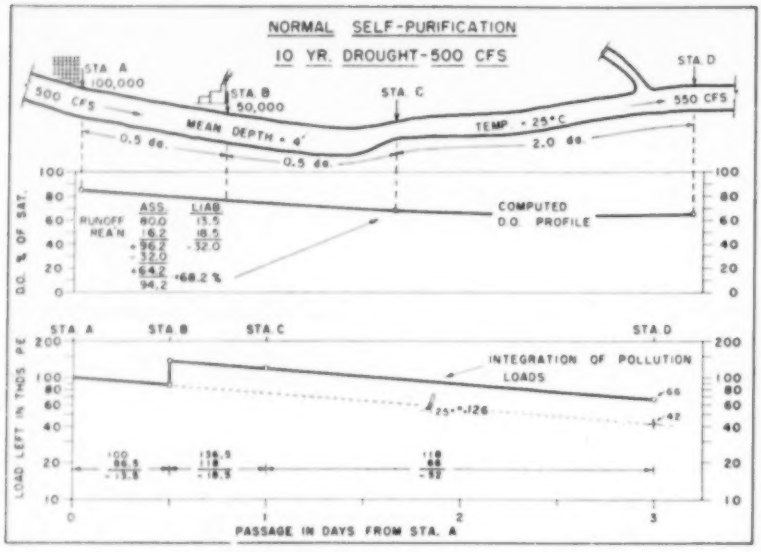


Fig. 4—EXAMPLE of normal river self purification
Upper curve shows essential data from which dissolved oxygen profile is computed. Lower curve integrate pollution loads.

deposit areas along the course. The slope of the cumulative time curve provides directly the velocity, the steeper the slope, the slower the velocity. The critical velocity at which organic sludge deposits may be expected is about .6 foot per second.

Laying off such a slope for a river along the time of passage curves immediately identifies where and under what runoff regimes sludge deposit trouble can be expected from existing or potential sources of waste containing settleable solids. Refined definition of river depth, velocity, occupied channel volume and time of passage for the range of expected drought flows is one of the major keys to accurate quantitative appraisal of stream recovery.

Application to the Stream

Let us now apply these fundamentals to the stream, dealing with more than one source of pollution and computing resultant dissolved oxygen profiles, to illustrate how *by stream analysis* various river situations can be evaluated.

The Debit Side of the Picture

First, let us deal with a normal self-purification situation under a drought severity expected on an average in the long run once in 10 years and a warm weather river water temperature 25° C. This is illustrated in Fig. 4. At Station A a city discharges a municipal pollution load of 100 thd. (100,000) population equivalent or P.E.* At Station B an industry discharges an additional 50 thd. P.E. C and D are two arbitrarily selected points downstream.

The once in 10 year drought severity provides at Station A a discharge of 500 cfs., and a tributary creek above D contributes an additional 50 cfs. At this runoff stage the physical characteristics of the channel determines the mean depth as 4 feet, and time of passage of .5 day between Stations A and B, .5 day between B and C, and 2.0 days between C and D.

The first job is to integrate the given pollution loads down the course of the river on the basis of times of passage. This is illustrated in the lower part of the graph. The logarithmic rate of decline at 25° C. is laid off as a control at the k previously obtained from Fig. 2 of .126. We have determined in this situation that there is no immediate demand and that channel velocities from time of passage curves do not provide opportunity for any sludge deposits to occur. Thus, we have a straightforward normal amortization schedule. At zero time at A we start out with a pollution debt of 100 thd. P.E. Paralleling the control slope $k_{25}°$, this declines to 86.5 thd. in .5 day to B.

At this point the industry contributes an additional 50 thd., P.E. raising the unpaid debts to 136.5 thd. Then proceeding at the normal rate parallel to the $k_{25}°$ slope, this declines to 118 thd. in the next .5 day to C, and to 66 thd. in the next 2 days to D.

Any point on the integrated line gives at once the amount of unpaid debt on the doorstep at that location. For example, there remains an unpaid debt on the doorstep of D of 66 thd. P.E. as a residual from the two pollution loads A and B. Rationally we might also ask what are the relative responsibilities of A and B? This is readily determined, by extending from 100 thd. at A along the dotted line to D giving a residual unpaid debt of 42 thd. from A on D's doorstep. Subtracting A's residual from the combined residual of 66 thd. leaves 24 thd. as B's contribution.

Since the integrated curve gives the amount of debt remaining at any location in time, the difference between any two points gives the amount of debt paid. Hence, the liability side of the ledger between A and B, B and C, and C and D along the river are 13.5, 18.5, and 52 thd. P.E., respectively. This is the debit side of the picture.

Dissolved Oxygen Assets

Now for the assets. In order to illustrate, let us just consider the stretch of river from A and C. Our oxygen assets are two sources, the dissolved oxygen contained in the stream flow or added by tributaries, and reaeration from the atmosphere. The dissolved oxygen assets from runoff of 500 cfs. depend upon how nearly saturated the stream is upon arriving at Station A. At 25° C. the saturation value is 8.4 ppm or 70 lbs. per million gallons of water which, for 500 cfs. (323 M.G.D.), would contribute 22.6 thd. lbs. per day or an asset equivalent to 94.2 thd. P.E. Seldom do streams, even under natural conditions, contain their full saturation value. Dissolved oxygen usually ranges between 80 per cent to 90 per cent of saturation, averaging about 85 per cent. The contribution at A from runoff is, therefore, 85 per cent of 94.2 or 80.0 thd. P.E.

Reaeration is a complicated computation involving oxygen deficits, occupied channel volume, mean depth, water temperature, and the physical and hydraulic characteristics of the channel which for our situation gives 16.2 thd. P.E. Striking a cash balance at Station C defines the solvency at that point.

Summarizing, we have assets from runoff of 500 cfs., 80.0 thd. P.E., and from reaeration 16.2 thd., making a total cash assets available of 96.2 thd. P.E. The debts paid, liability side, from A to C as taken from the integration below are A to B, 13.5 thd. and B to C, 18.5 thd., making a total of 32 thd. Subtracting debits from credits leaves a net cash balance on

* A convenient method of expressing assets and liabilities is in terms of population equivalents. If the total municipal pollution debt (oxygen required for complete amortization of the debt) of non-industrial cities discharged per day is divided by the contributing population, the normal per capita debt is approximately 0.24 lb. of oxygen per day. Thus, 0.24 lb. of dissolved oxygen per day is taken as one P.E. (population equivalent).

hand of 64.2 thd. P.E. Dividing net cash on hand by the saturation value 94.2 thd. gives a computed dissolved oxygen value at C of 68.2 per cent of saturation. Thus, our stream declined in D.O. from 85 per cent at A to 68.2 per cent at B. Continuing these computations similarly and striking a cash balance at D, dissolved oxygen would decline to 65.0 per cent of saturation. Thus, one could proceed down the river and through reaeration and contribution of dissolved oxygen from tributaries the stream would rebuild again the 85 per cent or better.

At this point, I should like to emphasize the dynamic character of stream recovery. As runoff varies the basic factors governing self-purification change and hence each runoff regime, for a given pollution loading, describes its own particular D.O. profile. Since the critical period is the coincidence of warm weather and low runoff, stream condition is directly tied to drought probability. Thus to evaluate stream recovery capacity, not one but a whole series of D.O. profiles must be computed.

Effect of Increased Flow

The second illustration, Fig. 5, dealing with the same river and identical pollution loads, evaluates what could be expected in the way of improvement in dissolved oxygen profile from a proposed upstream flow regulation development increasing the natural drought flow of 500 cfs. to a regulated minimum of 1000 cfs. Without taking you through all the steps in the computations, let us just see what this would mean, first in terms of change in the liability side and then in terms of the asset side of the ledger.

An increase in stream flow would raise the stage of the river from a mean depth of 4 feet to a mean depth of 5.3 feet. This would increase the occupied channel volume with more water to be displaced by runoff. But runoff is also increased, with the net effect of a reduction in a time of passage down the course of the river, .29 day to A to B, .38 day B to C, and 1.03 days C to D. Shortening the time of passage means less debts would be paid between these physical reaches, as illustrated in the integration below.

In terms of assets we have doubled our runoff at A and would thereby double our assets from this source. The net effect on reaeration is to reduce it slightly, the increase in volume to receive reaeration in the stretch is more than offset by the decrease in reaeration associated with increase in depth. Striking a cash balance at Station C, we compute a resultant dissolved oxygen of 78.8 per cent of saturation, and at D of 74.2 per cent. This is an improvement over the preceding profile and is a measure of the benefit to be expected from such a low flow regulation.

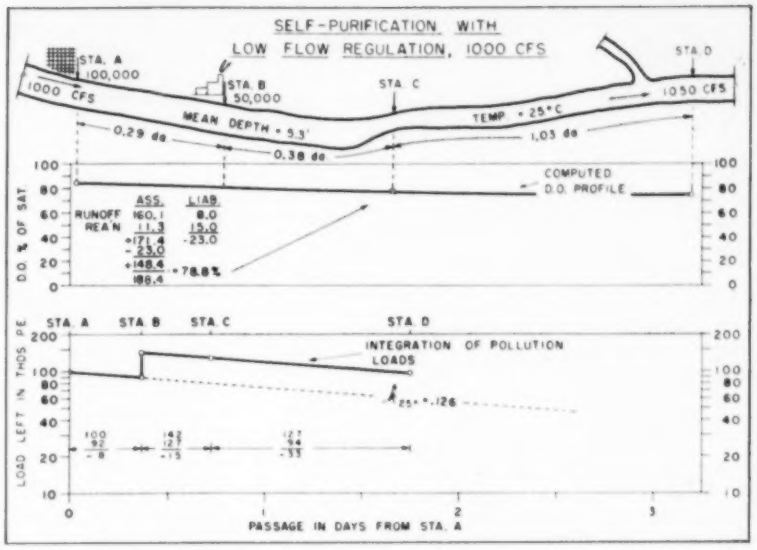


Fig. 5—SAME river, same pollution, but with regulated low flow
Illustrating the effect of increasing drought flow from 500 cfs. to a minimum of 1000 cfs.

Effect of Lower Velocity

Let us now consider the impact of another type of river development, as illustrated in Fig. 6. Again consider our same stretch of river. In conjunction with development of a steam power plant located in vicinity of Station C, it is proposed to build a low level dam across the river for the purpose of insuring a pool for water intake. It is computed that this dam would back up the river to about Station B and would increase the depth in this reach to about 7 feet and increase the volume in the pool such that at a runoff of 500 cfs., the time of passage between B and C would be lengthened from .5 day to 1.0 day. This slower time of passage would also reduce velocities to a level permitting settleable solids to deposit in the pool behind the dam.

Now, if A and B sources of pollution contain settleable solids, we are in for trouble. An analysis of the pollution loads indicates that for the city at A the fraction of B.O.D. in settleable solids form is 40 thd. P.E. and the fraction for the industry at B is 10 thd., leaving 60 thd. and 40 thd. in colloidal and dissolved form for A and B, respectively. We now have all the factors to proceed to evaluate this situation.

In the integration of the pollution loads each fraction is dealt with separately. First, we integrate the colloidal and dissolved fraction which remains in the flowing stream in the usual manner employing the new time of passage as shown on lower part of Fig. 6. Then, we separately integrate the settleable solids fraction, starting out with 40 thd. P.E. at A, which while remaining in the flowing stream declines in .5 day to 34.6 thd. at B; here it picks up an additional 10 thd.; the 44.6 thd. P.E. then continues to decline while remaining in the flowing stream until it reaches the pool behind the dam where the residual of the settleable fraction of the debts (33.3 thd. P.E.) then completely drops out of the flowing stream, and on successive days accumulates to equilibrium as sludge behind the dam. Striking a cash balance at Station C and summarizing, we have on the liability side a total of 81.4 thd. P.E. to be paid of which 33.3 thd. is from sludge deposits, and assets of 103.3 thd. P.E., giving net cash on hand at C of only 21.9 thd. P.E. or D.O. of 23.2 per cent of saturation. This illustrates how disastrously sludge deposits behind the proposed dam would adversely affect the stream.

Basic Data Required

From these simplified illustrations the basic information we needed in order to carry out such stream analysis evaluations and forecasts may be summarized as follows:

First, we need to know accurately the sources of pollution, the quantity (volume and strength), including a check for immediate demand and differentiation of the fraction of B.O.D. in the form of settleable solids from the colloidal and dissolved. Where unusual industrial wastes are involved, we also should have a B.O.D.

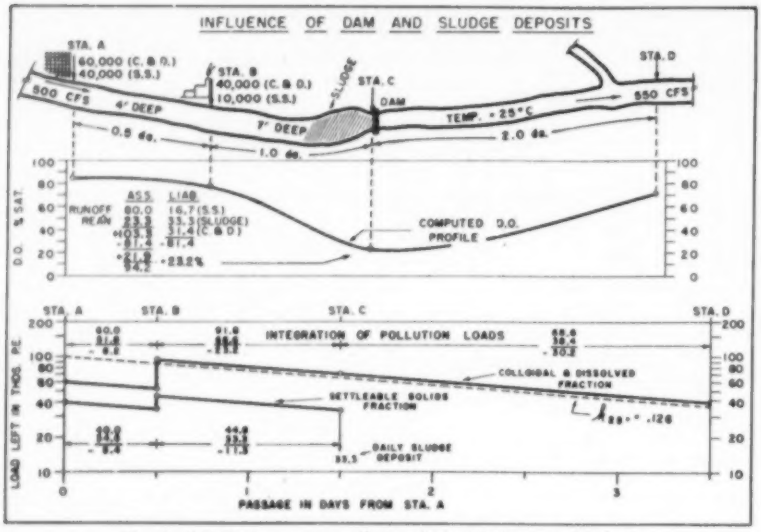


Fig. 6—SAME river, same pollution, but with dam constructed
Illustrating the effect of reduced flow velocity which permits settleable solids to deposit.

rate curve with determinations at .5, 1, 2, 3, 5, 7, 10, 15, 20 days. If pollution load determination is correlated with the daily plant production, variation in pollution load can be determined from daily production figures supplied.

Second, in addition to runoff records which are usually readily available, it is imperative to have a definition of physical characteristics of the stream channel with sufficient cross-sectioning to provide the factors needed in computing liabilities and assets. Third, which I have not thus far mentioned, reliable water course sampling should be obtained, at least under one steady hydrologic regime and pollution loading, for the purpose of an independent verification of computed stream conditions.

In conclusion, given good basic data, natural purification capacities of a stream can be quantitatively defined, so that forecasts can be made of what can be expected in water quality along the course from existing or potential sources of pollution under various drought probabilities and river developments. For a mature rational approach, good management implies comprehensive evaluation in advance of adoption of any abatement proposal. And good management also implies prevention. Time, effort and resources devoted to comprehensive appraisal of the waste disposal problem prior to the construction of new mills and expansions will be repaid many fold in pollution problems avoided.

Recovery of Polluted Streams

What Shall be the "Criterion of Reasonable Use" of a Given Stream?

A Discussion

by* SETH G. HESS, *Director & Chief Engr. Interstate Sanitation Comm., New York, N.Y.

THE SUBJECT of self purification of streams which receive organic pollution has been concisely reviewed by Professor Velz in his paper "Recovery of Polluted Streams."

It is important to note the universality and, indeed, omnipresence of Phelps' Law, regarding the rate of biochemical oxidation, in the form referred to by Professor Velz. Many undoubtedly are familiar with chemical reactions that occur at a rate directly proportional to the amount of primary material which is involved. In the field of physics, this first order reaction or logarithmic progress is evident in the decay of radioactive materials. The terminology of the physicist may be used to characterize the process of oxygenation, which Professor Velz discussed, by stating that the half life of the Biochemical Oxygen Demand at 20° C. is three days.

The ubiquity of the first order reaction is a source of continual surprise to me. In some work pertaining to the chlorination of sewage, which the Interstate Sanitation Commission has recently completed and which is soon to be published, this exponetial relationship—or first order reaction—was utilized in describing the rate of entry of chlorine into a bacterial cell. In other work we have frequently used the diminution of dissolved oxygen concentrations as presumptive evidence of pollution.

Non-B.O.D. Pollutants

Professor Velz has confined himself to one criterion of stream pollution, dissolved oxygen concentration. However, lest we become too narrow in our thinking, which I am sure was not Professor Velz's intent, I would like to interpolate a word in consideration of those types of pollution which are very real and yet have a minimal effect on dissolved oxygen concentrations.

Among these pollutants may be listed some dissolved gases, some inorganic acids and caustics, some toxic wastes, solid materials, either floating or settleable, and to some extent, heat content. The recovery of streams from polluting substances which do not affect dissolved oxygen concentrations may or may not follow an equivalent of Phelps' Law.

This does not deny that the dissolved oxygen criterion is most important in the determination of stream pollution. However, it may be possible for us to carry Professor Velz's analogy a step farther and consider the stream as a corporation having total assets of various kinds not confined solely to dissolved oxygen, any more than a corporation's assets are solely cash.

Allocation of Stream Assets

The question which now presents itself is: how much of the stream's total assets can we permit to be loaned for future repayment, how much can we afford to give away, and what is the measure of new capital (in the form of additional flow contributed by the confluence of other streams) which we will acquire as we go downstream? A part of the capital that we plan on giving away or disposing of without return would be for the dilution of compounds which can be accepted in limited amounts, such as salt (NaCl) or even small concentrations of poisonous compounds.

Someone, some regulatory agency, will establish the operating basis for these items. If it were a bank, banking laws under the direction of state banking examiners would apply to assure that the percentage of cash, of government bonds, notes, mortgages, etc., would be reasonable to preserve solvency.

This brings us to a realization of the *basic need* of knowing the purpose for which the stream is to be used. Consideration of basic need is becoming an accepted practice, and we hardly need dwell upon it at this time. However, we have not yet found an established formula of determining how much of the assets of a stream may be usurped by a single contributor.

No well organized bank would lend all of its money to a single client. No single municipality or single industry may usurp the entire capacity of a stream, even though in so doing the stream has not been despoiled to a point below the established standard for that stream. Certainly a future contributor of pollution (future in the sense of time, not location) has certain rights to the use of a stream. That has been recognized by our law in the form of riparian rights, whereby a downstream occupant has the right to the waters of the stream undiminished in quantity or quality, though he may not exercise those rights for years to come.

Criterion of Reasonable Use

At the present time, water pollution control authorities often determine the reasonable amount of a stream's capacity to accept pollution that shall be allocated to a particular contributor. The law may thus permit the reduction of the stream's capacity to accept pollution, providing the stream standard is not violated. This action, however, deprives the immediate downstream contributor of the same rights as his upstream neighbor—with the result that the upstream contributor may be required to provide little or no waste treatment, while his downstream neighbor may find it necessary to utilize a high degree of waste treatment because the stream has no further capacity to accept any waste without violating the established standard.

In some instances the control authority is permitted to use its judgment and determine the degree of waste treatment that should be given to reserve, for other contributor's yet to come, some part of the stream's capacity to carry away wastes. It may well be that the future will develop a law (another Phelps' law, or a law of exponential relationship, or one of first order reaction, call it what you will) whereby new plants or expanded plants may use the stream only in an amount related to the remaining capacity of the stream to accept pollution without violating the established stream standard.

Economics vs. Benefits

The paper presented by Professor Velz refers to critical periods of warm weather and low flow. When considering these critical periods, it might also be well to evaluate damage in these critical periods. If we consider a highly industrialized stream in an area used exclusively by industry, could we not accept a condition of zero dissolved oxygen that might occur once in twenty years, or accept such a condition once in ten years? I am sure the conservationists will rise to object to a fish kill even once in twenty years.

However, there is a time when consideration must be given to the balance of economics on the one hand and the benefits derived on another. If we make our designs on the basis of the worst conditions that may occur once in 100 or 500 years, we might indeed find ourselves committed to impractical expenditures. It will always be a nice question to decide the frequency with which we are willing to accept these unsatisfactory conditions, but it is a matter which we face and should face with our eyes open.

The Responsibility of Industry

The National Council for Stream Improvement (Pulp, Paper and Paperboard Industries, Inc.) has pioneered in the field of industrial responsibility for maintaining clean waters. The organization, its members, and its outstanding staff which has the respect and recognition of all interested in pollution control, are to be sincerely congratulated. The work accomplished has been emulated and should be further emulated by others.

It has frequently been said that one cannot order or direct the abatement of industrial pollution unless and until a reasonable means of treatment is available. The National Council has shown that such means can be developed in its industry. Similar results have been obtained in innumerable instances.

It occurs to me that we should no longer be satisfied to permit the discharge of pollution even when reasonable means are *not* available, *unless* adequate study is being made to find the means of treatment. The measure of the effort to find the means of adequately treating the wastes could readily be evaluated by the amount of money being spent on properly controlled investigations and research. The amount of money spent should be equal to the cost of operating interest and authorization of the so-called "reasonable cost" to build and operate treatment works if a method were available.

If industries or processes that claim "no known method of waste treatment" were annually required to place such an amount of money into research or investigation, I feel sure it would be but a short time before adequate treatment methods would be found. The results would accrue not only to the benefit of stream pollution control but likewise to the benefit of industry itself.

Plan 3rd Southern Municipal and Industrial Waste Conference

The Third Southern Municipal and Industrial Waste Conference will take place at North Carolina State College, March 18 and 19, 1954. This conference will feature a symposium on—(1) Legal aspects of stream pollution; (2) Research (municipal, industrial, and educational) activities; and also separate technical sessions for various types of wastes. Dr. Nelson L. Nemerow of State College is chairman of the conference.

Proceedings of the Second Conference are now available and may be purchased from the Department of Sanitary Engineering, Univ. of North Carolina, Chapel Hill, N.C. The price is $1.00.

> No nobler attitude exists than that of admiration for one higher than himself.

How Sanitary Biologists Contribute To Waste Treatment Processes

Experience Shows Improved Methods are the Result of Cooperative Studies in This Field

by **JOHN N. WILSON,** ***Basin Biologist, U.S.P.H.S., Div. of Water Pollution Control, Portland, Oregon***

IN recent years sanitary biologists have been taking a more active part in the field of public health. Many state health departments are undertaking biological studies in connection with their sanitation problems. Moreover, since the passage by the 80th Congress of Public Law 845, the Water Pollution Control Act, the Public Health Service has reactivated its Biology Section at the Environmental Health Center in Cincinnati, and has placed biologists in all but two of the ten Drainage Basin Offices of the Division of Water Pollution Control.

Sanitary bacteriologists have been active in the fields of sewage treatment, water supply and stream sanitation for many years. These workers deal with the smaller organisms which may be identified by cultural methods. The tests for coliform bacteria and fecal streptococci as pollution indicators, as well as work on the isolation of zoogloea and experimentation on these organisms in pure culture, represent important milestones in bacteriological research.

Sanitary Biology is Still Young

Compared to bacteriology, sanitary biology as applied to stream sanitation and sewage treatment is an infant science with many of its procedures, refinements, and applications still to be worked out[1]. Sanitary biologists depend upon direct observation of organisms in their natural state or in stained preparations—whereas bacteriologists use culture media and identify most organisms by their growth and behavior. The biologist deals with a wide variety of organisms which range in size from minute flagellate protozoa (some of which are smaller than many bacteria), through the algae and fungi, to annelid worms, insect larvae, and fishes.

The need for basic as well as applied research in the field of sanitary biology is expressed by an editorial in a recent issue of Sewage Works Journal[2]: "The biological aspects of sewage and industrial waste treatment processes have by no means been ignored in the past, but we need to know a great deal more about them. When we can answer completely the what, how, who, when, and why of the organisms that populate our digesters, aerators, and trickling filters, we shall simultaneously solve the problems of treatment plant design and operation that are of present concern."

In the meantime, while biological research is in progress, what are some of the ways in which our present knowledge of sanitary biology may be applied to advantage in sewage treatment?

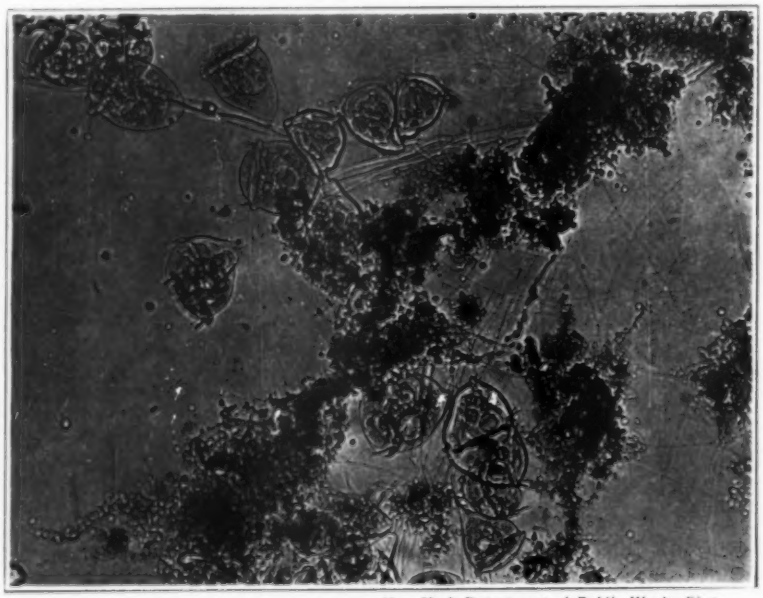
The Activated Sludge Process

The satisfactory operation of aeration units in activated sludge plants may be determined by periodic microscopic examination of the sewage-sludge mixture for the occurrence and distribution of indicator organisms. Predominance of certain infusion protozoa, such as *Paramecium* and *Colpidium* in the returned sludge, indicates an overloaded plant. The presence of *Vorticella, Opercularia,* and *Aspidisca* indicate a healthy and more stable returned sludge.

The occurrence of midge larvae *(Chironomidae)* in activated sludge may be detrimental if they are abundant enough to destroy the sludge. A consulting biologist may be of service by discovering and controlling midges before they multiply to the danger point.

Contact Aeration Treatment The Hays Process

The Hays process of biological treatment is similar to activated sludge treatment, except that asbestos plates are suspended two inches apart throughout the aeration tanks to provide attachment surfaces for the growth. The original plan of the proponents of this process was to segregate the carbonaceous oxidative processes in the primary aerator and the nitrification processes in the second-



New York Department of Public Works Photo

ACTIVATED SLUDGE under the microscope

Typical appearance of zoogeal masses and stalked ciliates.

ary aerator, with a settling tank between. By this means, a so-called "biological gradient" could be established which apparently was akin to the succession of organisms in a polluted stream below a sewer outlet[4].

Biological and engineering studies made on plants of this type in the southwest during World War II by the author[5] and by Lackey and Dixon[6] showed that where such plants were operating beneath their designed capacity, the biological gradient could be demonstrated through the use of indicator organisms. However, where plants of this type were loaded to or above design capacities, anaerobic conditions prevailed in the aerators. This condition was accompanied by a change in the fauna and flora to anaerobic forms which are characteristic of sludge digestion chambers.

To correct this condition, it was necessary either to interpose a trickling filter in the system or to recirculate some of the flow. It was concluded from this finding that it was more important to maintain aerobic conditions than to retain the biological gradient by straight-line flow.

Trickling Filter Treatment

Although high rate trickling filters under proper operational conditions do not pond as do many standard rate filters, unusual conditions may produce ponding. One case was reported where a high rate filter had operated satisfactorily for many months when it began to pond near one edge over about one-third of its area. Several methods of control were tried only to have the ponding resume within a short time.

Microscopic examination of the growth in the troublesome section indicated predominance of white sulfur bacteria, *Beggiatoa alba*. As the ground water in the area contained large concentrations of sulfates, the increase of these sulfur bacteria in the ponded area suggested ground water infiltration. Inspection of the outer well of the filter on the ponded side revealed a number of cracks in the concrete near a spring. The water entering from the spring had a very high content of sulfates.

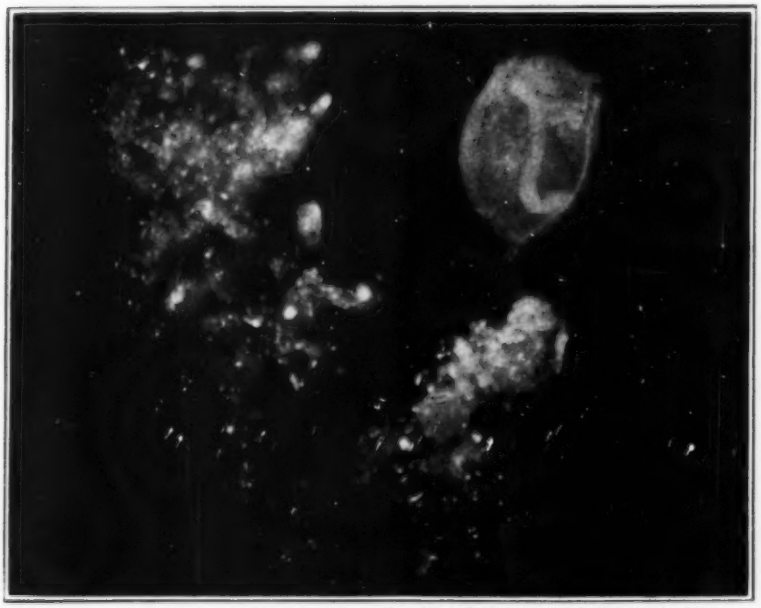
The biological growth or film which occurs on the rocks in trickling filters is a complex assemblage of plants and animals. Organisms comprising the film may be divided into three groups on the basis of their function: the *binding* organisms; the *free-living* organisms; and the *scouring* or *grazing* organisms. The members of the binding group comprise the fibrous-gelatinous matrix of the biological film. The slime bacteria of the zoogloeal group, certain fungi, filamentous algae and white sulphur bacteria, such as *Beggiatoa alba* referred to above, are among the representatives of this group.

The free-living organisms include certain higher bacteria, protozoans and rotifers. Many smaller protozoans feed on dissolved substances in the sewage, but the larger protozoans and rotifers consume large numbers of bacteria. This last activity is of prime importance in the efficient operation of trickling filters. According to Butterfield, et al,[4] ". . . . . the chief function of certain protozoa in the biochemical oxidation process is to keep the bacterial population reduced below the saturation point and thus provide conditions suitable for continuous bacterial multiplication, this in turn resulting in more complete oxidation."

Experience with trickling filters in England has shown the importance of cultivating and maintaining a balanced scouring or grazing fauna such as worms, insect larvae, and the like. These organisms consume sewage solids and excess growth (thereby enhancing aeration) to prevent ponding and to assist in stabilizing the sewage. Nuisance from adult filter flies *(Psychoda spp.)* is at a minimum where the population of other macrofauna such as chironomids is sufficient. Nevertheless, a certain amount of fly trouble is considered to be inseparable from low-rate filter operation[7].

Sewage operators in the U.S.A., however, are of the opinion that the benefits derived from these organisms seem to be overshadowed by the nuisance which they create in the immediate vicinity of the plants. Ordinarily, standard filters cause more fly trouble than high-rate filters. This is attributed to the cycle of dosage on standard filters which allows rest periods between applications—the cycle gives time for the adult flies to emerge and to escape from the filter. The continuous and high rate of dosage on the high-rate filter not only flushes out large numbers of flies in all stages of development, but also interferes with the escape of winged adults.

Nevertheless, experience shows that many high-rate filters, particularly in the South, have had exceeding heavy growths of *Psychoda spp.* Experiments by Brothers[8] and Carollo[9] have contributed materially to our knowledge of the control of these flies through the use of DDT. Recent reports on the application of DDT to filters indicate the development of resistant strains of filter flies, making it necessary to increase dosage of this chemical to the point where it may adversely affect beneficial organisms in the filter, and may cause loss of fish in receiving water. Other methods of filter fly control such as chlorination, flooding, backwashing, etc., will not be discussed here. There have been, however, recent reports of research on control of *Psychoda* with other organic compounds, some of which may have merit.



New York Department of Public Works Photo

DARKFIELD ILLUMINATION of activated sludge
A striking illustration of *Vorticella* at work.

Industrial Waste Lagoons and Sewage Oxidation Ponds

Lagoons for temporary storage of seasonal industrial wastes, such as cannery and beet sugar wastes, have been the subject of recent investigations. Some of these projects have been studied chiefly with reference to physical or chemical aspects, such as the report of Riedesel and Lawson[10] on freezing as a factor in the stabilization of corn waste. Other investigators such as Halvorson, et al, emphasize the bacterial and engineering aspects in the use of an aerofilter as an adjunct to a lagoon in the treatment of corn cannery waste.

Biological research is being conducted at the present time on the occurrence of red sulfur bacteria in vegetable cannery wastes. The lagoon in southern Minnesota, where this investigation is under way, contains a persistent brick-red growth—presumably red sulfur bacteria—which causes a rapid stabilization of the wastes with little odor. The current research includes both mass transplantation of this beneficial growth to other lagoons and laboratory cultural experiments.

The treatment of settled sanitary sewage in oxidation ponds is rapidly gaining in popularity in the more arid regions of the west and southwest. Caldwell[11] reported on this method of biological treatment, with particular emphasis on engineering and chemical phases. Plans are now underway for conducting laboratory experiments simulating field conditions in such ponds. As *Euglena spp.* are the principal components of the biota in these ponds, the laboratory tests are designed to culture these organisms and determine their metabolic and nutritive characteristics.

There is need for more emphasis on biological research on a pilot plant scale to determine the most efficient means of operating oxidation ponds. Studies, on a similar scale, of trickling filters and sludge digesters are also needed. The biology section of the Environmental Health Center, in Cincinnati, is contemplating research along these lines in the near future.

Need For Cooperative Studies

In the past, according to Sawyer[12], the greatest strides made in the development of methods of sewage treatment have resulted from combined studies of bacteriologists, chemists, biologists, and sanitary engineers. Let us strive for continued and even closer cooperation and teamwork among these professions, because it has been repeatedly demonstrated that only through such concerted effort may we avoid pitfalls and achieve lasting progress in the field of sewage treatment.

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John D. McDonald Becomes Engineer of Public Works

In a well-deserved promotion, John D. McDonald, formerly superintendent of sewage treatment, has been appointed Engineer, Board of Public Works, Springfield, Mass.

The Board has charge of engineering, design, preparation of reports, and drafting of recommendations for the City Council. Thus, except for three city departments (Water, Public Building, and School), "John" will "have a finger in everybody's pie." He brings a wealth of practical information to the new job, and the City of Springfield is to be congratulated for this recognition.

To Roanoke, Virginia, Our Apologies

What is to follow is proof enough that it is sometimes hazardous to rely upon newspaper stories for accuracy when some reporter wants to make headlines.

The present instance is in connection with the item captioned "New Use for Geophones" that appeared on page 415 of our October issue, reporting the location of a cocker spaniel puppy which had run into a main extension, the end of which had been left open. After five days in the main (according to the story) the puppy was located 225 ft. from the point of entry. Location of the pup's position was accomplished through use of one of Roanoke Water Dept's. "Geophones" which picked up the spaniel's puny whimpers. The pup was taken out alive and recovered from his five-day ordeal, as the result of having chased a squirrel or rat into the main.

Quick to correct several errors in this human interest newspaper story were C. E. Moore, engineer in charge of construction, and G. H. Ruston, manager of Roanoke's Water Dept., who had the following to say. First, the incident took place out in the county, not in the city. Second, the line was a terra-cotta drainage line, not a water main. The size was 8 inch pipe, not 4 inch. The dog was a full grown spaniel, not a young puppy.

In addition to the above corrections Messrs. Moore and Ruston let it be known in no uncertain terms that water main extensions in Roanoke are *never* left open for even a b-coli to squeeze in, much less a rat or squirrel. Furthermore, Roanoke does not permit rats to run loose in its corporate limits.

All that we can say at this juncture is that we'll never again believe what we see in Roanoke newspapers about water mains until the story is checked. Roanoke's Water Department is due, and herewith has, our apologies for failure to check the accuracy of the newspaper account before drawing upon it for what we thought to be a good human interest story.

Two Governors Participate in Ground Breaking for Cincinnati's $22,000,000 Sewage Treatment Plant

Many Other Dignitaries and Stream Control Authorities Also Take Part

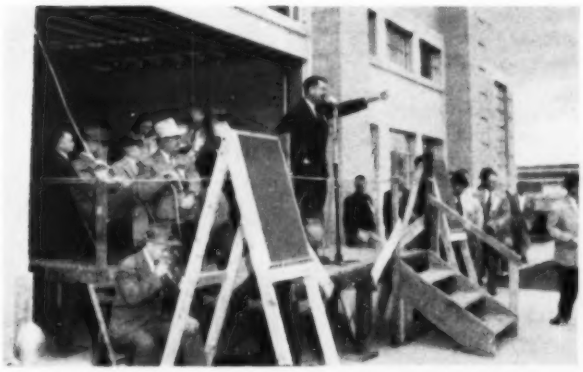
The "Clean Waters Rally," staged in Cincinnati, Ohio, on October 6th, was keynoted by ground-breaking for Cincinnati's second major sewage treatment plant—the Mill Creek plant which will cost $22,000,000. Another feature of the "Clean Waters Rally," sponsored by the Cincinnati Chamber of Commerce, was the dedication of the city's new Little Miami plant, just completed.

This unique rally, with history making participation by two state governors, attorney generals, city managers and more than 100 mayors of Ohio River Valley cities, was staged to emphasize progress in stream pollution abatement in the Ohio Valley and draw attention to the need for stepping up the program for pollution abatement. The rally was fruitful in the latter direction with 350 persons—notably mayors and other high authorities attending.

Principal speakers included Governor Frank Lausche of Ohio and Governor Weatherby of Kentucky; Attorney General O'Neill of Ohio; City Manager Kellogg of Cincinnati; Dan. M. Heekin, chairman of the Clean Waters Rally. Also in the lime light (and deservedly so according to our book) was Hudson Biery, chairman of the committee on stream pollution abatement of the Cincinnati Chamber of Commerce. He was the ice-breaker for the Ohio River Valley clean up movement and has worked tirelessly and successfully to line up the eight states in the Ohio River Compact.

Lauded also was the late publisher of the Cincinnati Enquirer—W. F. Wiley—who up to his death had championed the cause of stream pollution abatement for 30 years or more, working closely with Hudson Biery's pollution abatement committee in the Chamber of Commerce.

Believed to be the first "Clean Waters Rally" in history, the dedication of Cincinnati's first major treatment plant and launching construction of the second, with two others to follow, was spectacular, impressive and creative of something new in efforts toward lime-lighting and popularization of pollution abatement programs.



(1)—Arthur D. Caster, Sewage Disposal Engr. for Cincinnati, speaking to (2) some of the 350 in attendance for the dedication of the new Little Miami Treatment Works of Cincinnati, Ohio. (3)—Dave P. Backmeyer, Sup't. of the Little Miami Plant, describes features of the plant to some of the many attending mayors. (4)—Some of the participants in the ground-breaking for the $22,000,000 Mill Creek Treatment Works. Left to right: Dan M. Heekin, chairman of the Chamber of Commerce's "Clean Waters Rally"; Governor Lausche of Ohio; H. E. Moses, Pa. Dept. of Health, now chairman of the Ohio River Valley Water Sanitation Comm.; Cincinnati's Mayor C. W. Rich; W. R. Kellogg, City Mgr., of Cincinnati; Clarence W. Klassen, Chief San. Engr. of Illinois. Also participating was Gov. Weatherby of Ky., who is seen between Gov. Lausche and H. E. Moses, with light hat holding a shovel on the stand in the plant dedication picture.

REPORT FROM ABROAD

What the Other Fellow Thinks Describes Conference of the British Sewage Institute

by JOHN FINCH, *Manager, Sewage Disposal Department*
Rotherham, England

THE Institute of Sewage Purification Conference this year gave every delegate present plenty to think about after choosing from the internationally flavoured dish of technical contributions provided during the proceedings. We had a South African President installed in office, a treatise on sludge digestion trends presented by Dr. William Rudolfs from the U.S., and a paper describing modern sewage treatment trends in Germany given by Dr. Ing. H. Rohde. On top of this array of talent, we had delegates attending from France, Spain, Belgium, Switzerland, and Germany!

Never was there a better opportunity of exchanging ideas and opinions with men supreme in their particular spheres, men with whom one comes into personal contact on only a very few occasions. There is nothing more instructive than hearing and discussing the other man's point of view, as is made possible by conferences and meetings of this sort.

Dr. Harold Wilson, the new President of the Institute, lately Bio-Chemist to the City of Johannesburg and formerly Principal Research Officer to the Water Treatment Division of the South African Council for Scientific and Industrial Research, is now a Consulting Chemist on the treatment of water, sewage and industrial wastes. He was one of the founder members of a branch which has exerted a very profound influence on matters connected with sanitation, in a country where water is a raw material of the greatest importance, and where the shortage of it is really a major factor in holding up industrial development.

In proposing a vote of thanks to the new President, Dr. Hamlin—a past-President of the Institute and a South African—gave some idea of the tremendous amount of work that had been carried out by Dr. Wilson and his colleagues, and of the tasks in water supply, and sewage and industrial waste treatment, that remain to be solved in South Africa.

Dr. Rudolfs on the Program

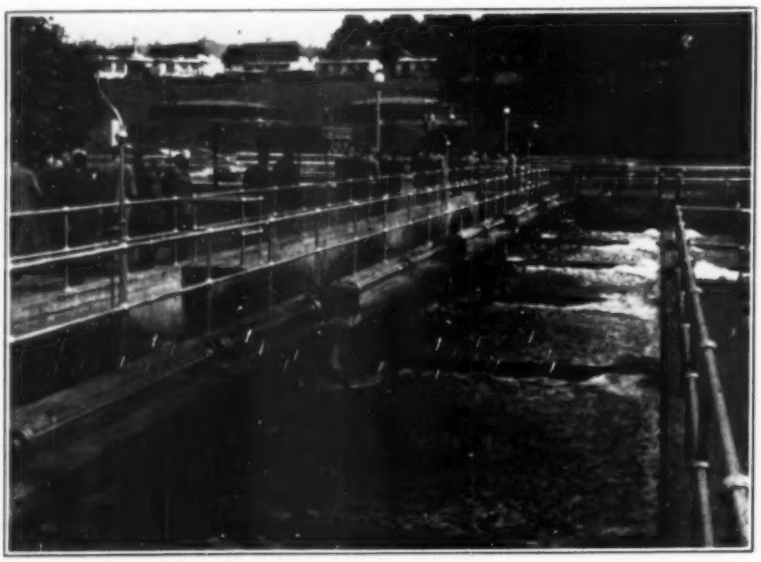
Dr. Rudolfs' contribution to the conference was a highlight of the proceedings on account of the speaker's international reputation in the sewage treatment field and the high esteem in which he is held in this country.

Dr. Goldthorpe, chief of the Huddersfield Sewage Department, right handsomely proposed the vote of thanks to Dr. Rudolfs, but drew the gentle rebuke of the recipient when he (Dr. Goldthorpe) commented that experience with the Huddersfield sewage treat ent problems had made him somew. t alergic to biological processes of treatment! A really tough sewage treatment problem exists at Huddersfield, as indeed it does at several other sewage treatment plants in the Yorkshire-Lancashire district.

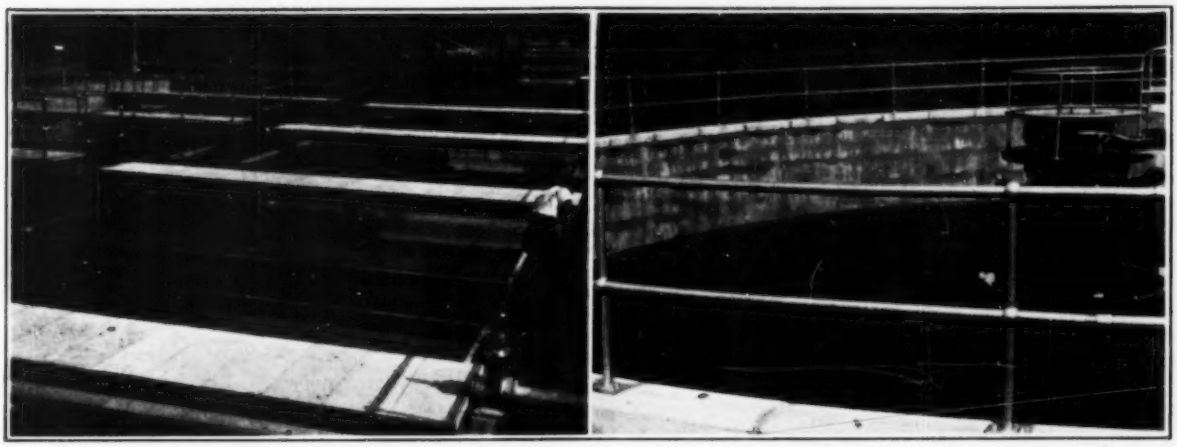
Incidentally, I had the pleasure of meeting Dr. Rudolfs in 1936 when he visited Britain, and was particularly glad to renew his acquaintanceship after almost 17 years. As I was walking along to the official reception at the Marine Spa in Torquay, I espied Dr. Rudolfs in the distance, apparently enjoying the view of the beautiful sea waters of the harbour, but, as I found out in due course, actually bemoaning his fate at being unable to purchase cigarettes at 7:30 in the evening!

Secondary Treatment Required in German Plants

Dr. Ing. H. Rohde's contribution to the proceedings of the Conference (on recent sewage treatment developments in Germany) was well received.



PLANT INSPECTION—the Plymouth Camels Head treatment works
Surface aerators of the Simplex type provide secondary treatment. Note close proximity of houses in background.



SETTLING UNITS at the Camels Head sewage disposal plant, Plymouth
Left, the rectangular primary settling tanks. Right, one of the circular final clarifiers.

Not only did it conform with delegates requirements of telling what the other fellow thinks and is doing, but it also told what is taking place in a country which has produced much of value in the development of sewage treatment practice.

Dr. Rohde stated in his paper that, as almost all German towns and industrial plants are situated on large rivers, it was considered to be sufficient in the early days of sewage treatment to provide screening and primary settlement only. The growth of population however, and increasing industrial expansion caused such extensive pollution to the rivers that more complete treatment is considered an urgent necessity. It now has become absolutely necessary to increase the efficiency of sewage plants, at least of the larger ones, by biological processes.

In pursuing this policy efforts are being made to increase the efficiency of settling tanks by improving the design of the inlet structures. These efforts are directed towards a better utilization of the clarification capacity, as it has become obvious that the actual detention period largely depends on the hydraulic characteristics of the tank.

In the design by Dr. Geiger of Karlsruhe, the sewage flows into the settling tank through a series of downward inclined short tubes, each terminating in a tee-inlet. Adjacent inlets face each other, and baffle plates are installed between them so that the sewage can spread along the planes of symmetry between the openings.

The so-called "Stengel" inlets installed by Passavant at the Stuttgart-Mohringen sewage treatment plant are designed on the same principle. The inlets are there installed at half the depth of the tank.

In Germany the trickling filter is the most popular form of biological treatment, and the process experienced a marked revival of interest when the high rate filter was introduced some 20 years ago. Loadings of the trickling filters which are rated as *high rate filters* are as follows: 1 cubic metre is loaded with settled sewage from 20-25 persons (basis of .077 lb. B.O.D. per capita) and the surface loading must not be less than 0.8 cubic metre per square meter per hour.

Examples of high rate filter plants in operation were cited which show reduction of B.O.D. of the order of 74 to 87 per cent.

Since high rate trickling filters were introduced, only a few activated sludge plants have been built in Germany. The Wupperverband is at present constructing an activated sludge plant at Wuppertal—Buchtenhofen, which is to be used as a high rate plant in accordance with experience in the U.S.A.

MODEL of storm water siphon designed on Braine's principles

Another plant to be built for pilot studies may produce some of the most interesting results in the activated sludge field, when investigations into coarse bubble aeration are inaugurated. This work, to be carried out with the use of jets and by other means, appears to have something in common with the pioneer studies in the U.S. by E. B. Mallory of Tenafly, N.J. Should the German investigations prove to be successful, then any published data will be eagerly awaited, especially, by activated sludge plant operators who have suffered from the vagaries of conventional air diffusers.

High Intensity Cones Improve Aeration

A paper on "The Problems of an Overloaded Sewage Works," by Mr. F. W. Allen, presented plenty of opportunity for discussion.

The Bolton (Lancashire) sewage amounts to some 6.5 mgd, of which 1.8 mgd consists of trade effluents The average four hours oxygen absorbed value of these trade effluents is about 600 ppm, and the average oxygen absorbed value of the dry weather sewage about 250 ppm. Some measure of the resistance of the Bolton sewage to biological oxidation may be inferred from the ratio of the B.O.D. to the four hours oxygen absorbed value which is about 1.5, whereas with domestic sewage this ratio is usually 3 or more. It will be seen from these figures that the trade effluent which is substantially tanneries waste, is responsible for over 50 per cent of the total load on the sewage treatment plant.

The treatment plant at the Bolton works comprises, essentially, primary settling tanks, a Simplex surface aeration activated sludge plant, followed by settlement in hopper-bottomed tanks, and then final treatment of this effluent on nitrifying filters.

Recently, conversion of the Simplex surface aeration plant from the standard shallow aerating cones to the new deep high intensity cones, has caused an improvement to be effected in the character of the final effluent from this plant.

The horse-power per million gallons figure for the high intensity cone conversion went up to 53 as compared with 28 for a similar section operating with the standard cones. At the same time, with the detention period at 7.5 hours in the aeration tank, the B.O.D. for the high intensity section was 17 ppm against 60 ppm in the standard cone unit.

Most of the discussion on Allen's paper was centered around the operational efficiency of the Ames Crosta Mills' high intensity cone units used in the surface aeration plant at Bolton.

As a means of comparison, several speakers gave details of the results obtained with these high intensity cones at their own respective sewage treatment plants. The consensus of opinion appeared to be that the increased degree of sewage treatment accomplished by the high intensity cone conversion in an existing tank is about proportional to the increased horse-power demanded by the cones, with a limit at the present time of about a 30 to 50 per cent increase.

A New Siphon Design

A participant in the Conference discussions—particularly the discussions on the contributions by Dr. Rudolfs and Dr. Ing. Rohde—was Mr. C. D. C. Braine, Consulting Engineer, noted for his considerable amount of investigation into the operation and design of siphons and siphonic overflows (see illustration). During the course of his discussion, Mr. Braine, with a facility of mind characteristically his own, was able to clearly demonstrate points of design in sewage treatment plants by illustration on the several parts of what can only be described as the "multi-purpose" microphone assembly.

Plymouth Treatment Plant Inspected

One of the visits organized for the Conference delegates was to the Plymouth Camels Head Sewage Disposal Works. The Camels Head scheme comprises screens and disintegrators; grit channels; primary settling tanks of the inverted pyramid upward flow type; activated sludge treatment by the Simplex process, with diffused air sludge re-conditioning units; circular final settling tanks having conical floors with mechanical desludging mechanism; and two stage sludge digestion at 80-90 degrees Fahrenheit, followed by gas collection.

The sewage treated at Camels Head is weak to medium in strength as judged by British standards, having an oxygen absorbed value of about 60 ppm. The final effluent discharged from the plant has an oxygen absorbed value of 11 ppm, and a suspended solids value of 19 ppm.

The primary settling tanks provide a detention period of 6.8 hours at dry weather flow (upward velocity 6 feet per hour). The Simplex aeration plant has a capacity of equivalent to 8 hours detention at dry weather flow, followed by 3 hours reconditioning of the sludge. The final settling tanks are four in number, 45 feet diameter by 18 feet deep, with inverted conical floors sloping at 30 degrees to the horizontal.

An interesting feature of the final settling tanks is the scraper mechanism which consists of a series of drag chains resting on the conical floors, and also the use of rubber squeegees for the sludge sumps.

Torrington Treats Industrial Waste

The Torrington Sewage Disposal Works, also visited, are designed to deal with sewage containing a very high proportion of dairy waste in relation to domestic sewage.

The disposal works were designed to deal with a flow of sewage of 168,000 gal. per day, made up of only 18,000 gal. of domestic sewage plus 150,000 gal. of dairy waste! The make-up of the sewage is: 100,000 gal. per day of waste with a B.O.D. of 1100 ppm; 50,000 gal. with a B.O.D. of 800 ppm; and the domestic sewage with a B.O.D. of 350 ppm. The resulting mixture has a B.O.D. of around 930 ppm!

The scheme consists of alternating double filtration with recirculation, the latter to reduce the biochemical oxygen demand of the settled sewage to about 300 ppm prior to filtration. The filters are two in number, 90 feet in diameter by 6 feet deep, having a total capacity of 2830 cubic yards; they are designed for a dosage of 160 gallons per cubic yard per day.

In operation, this little scheme produced effluents having a B.O.D. content varying between 4 and 16 ppm and a suspended solids content between 12 and 40 ppm; this despite severe ponding at one time caused by the inclusion in the top layers of filter media of "fines" which, of course, should never have been there.

The design of this plant includes one primary settling tank of 6 hours capacity, with a maximum upward velocity of 4 feet per hour; and humus tanks in duplicate, each having a capacity equivalent to 4 hours detention with maximum upward flow velocity of 8 feet per hour. One humus tank is used as a primary and the other as a secondary tank, irrespective of the alternation effected in the use of the filters. The Torrington Works was constructed during the period 1951-52 at a cost of £28,850.

A M Rawn Elected Chairman Pollution Control Board

A M Rawn,* Chief Engineer and General Manager, Los Angeles County Sanitation Districts, Calif., has been elected chairman of the State Water Pollution Control Board to succeed General Warren T. Hannum, retired State Director of Natural Resources.

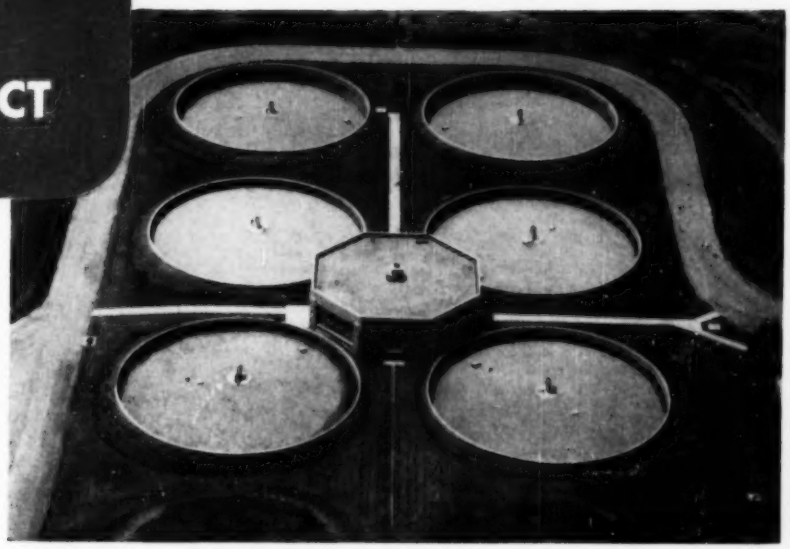
Mr. Rawn was appointed by Governor Earl Warren when the board was organized in December, 1949. This board consists of five state officials and nine appointees representing seven fields concerned with water pollution control. Mr. Rawn represents the field of sewage disposal on the board. He is also a member of the Water Pollution Control Advisory Board to the U. S. Public Health Service and has served on a number of sewerage survey consulting boards, including the East (San Francisco) Bay Cities, Orange County, San Diego County, and the current Greater Vancouver Sewerage and Drainage Survey.

*Editorial Associate, *Water & Sewage Works.*

They know enough who know HOW to learn.—*Henry Adams.*

ACCELERATED SLUDGE DIGESTION NOW A FACT

*Exclusively through the Catalytic Reduction Process**



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CATALYTIC REDUCTION PROCESS

The Catalytic Reduction Process completes biological sludge digestion in one-third to one-fourth of digester volume generally required. The Process accomplishes this by digesting at solids loading rates three to four times those being practiced. This accelerated digestion is simple and economical, using only the natural products of anaerobic decomposition.

Originating in 1946, the Process was developed, tested and verified over six years on both laboratory and pilot plant scale. The results obtained in the pilot plant operation have been proven in full scale plant operation at the Columbus, Ohio Sewage Treatment Works in 1952 and 1953.

The Catalytic Reduction Process applied to one 70′ tank at the Columbus Plant digested 3.38 times the quantity of sludge solids digested in a similar tank in parallel operation not using the Process. The tank operated under the Process produced a reduction of solids within established ranges, normal gas production and readily driable odorless sludge.

The Catalytic Reduction Process is now available for consideration by consulting engineers for application on plants under design and for plants requiring expansion. The Process when applied to overloaded digesters will provide sufficient capacity without additional tanks.

**The only proven Process for accelerating biological digestion. (Patents applied for.)*

The Catalytic Reduction Process is offered through the Catalytic Reduction Co., Inc. a subsidiary of the Chicago Pump Company.

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SEWAGE EQUIPMENT DIVISION

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Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

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... and a Budget Problem, too!

1. Costs Far Less to Install!
A Ranney Water Collector will add millions of gallons to your daily water supply—at a fraction of the cost of conventional systems!

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A Ranney Water Collector is far less expensive to operate—uses fewer pumps, fewer personnel, less power, and usually requires no treatment facilities.

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A Ranney Water Collector requires little or no maintenance. The rate of flow through the Ranney Collector's apertures eliminates clogging and silting. No filter plant maintenance.

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A single Ranney Water Collector has produced more clear, cool water than ten conventional vertical wells.

5. Far Longer Life Cuts Depreciation Costs!
The longer life of a Ranney Water Collector lowers financing and depreciation rates appreciably.

6. Ask These Satisfied Users
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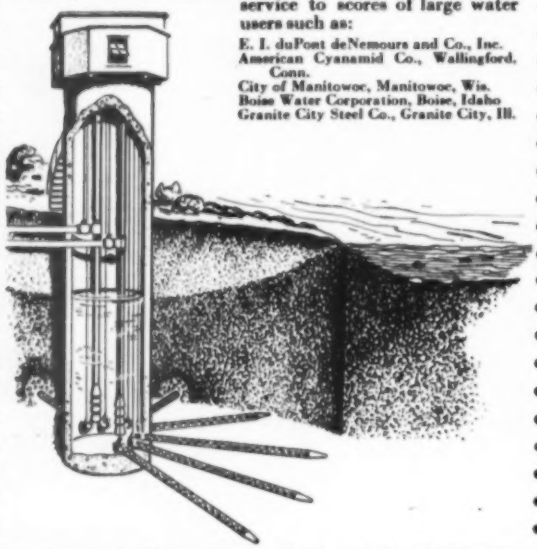
City of Manitowoc, Manitowoc, Wis.
Boise Water Corporation, Boise, Idaho
Granite City Steel Co., Granite City, Ill.



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Meetings Scheduled

Dec. 13-16—St. Louis, Mo.
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. (Annual Meeting). Sec'y, E. G. Van Antwerpen, 120 East 41st St., New York 17, N.Y.

Dec. 17—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Jan. 19, 1954—New York, N.Y. *(Hotel Commodore)*
NEW YORK SECTION A.W.W.A. (Winter Luncheon Meeting). Sec'y, Kimball Blanchard, 50 West 50th Street, New York, N.Y.

Jan. 21-22—New York, N.Y. *(Hotel Belmont Plaza)*
NEW YORK SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, R. C. Sweeney, 21 No. Broadway, White Plains, N.Y.

Jan. 21—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. (Monthly Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Feb. 9-10—Portland, Me.
MAINE WATER UTILITIES ASSOCIATION. (Annual Meeting). Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Feb. 10-12—Indianapolis, Ind. *(Lincoln Hotel)*
INDIANA SECTION A.W.W.A. Sec'y, Geo. G. Fassnacht, 1330 W. Michigan St., Indianapolis 7, Ind.

Feb. 16—Newark, N.J. *(Essex House)*
NEW JERSEY SECTION A.W.W.A. (Winter Meeting). Sec'y, C. B. Tygert, P.O. Box 178, Newark, N.J.

Feb. 18—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. (Monthly Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Feb. 25-27—San Francisco, Calif. *(Fairmont Hotel)*
AMERICAN CONCRETE PIPE ASSOCIATION. Director, Howard F. Peckworth, 228 No. LaSalle Street, Chicago, Ill.

Mar. 10-12—Atlantic City, N.J. *(Traymore Hotel)*
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Michael S. Kachorsky, P.O. Box 766, Manville, N.J.

Mar. 17-19—Chicago, Ill. *(LaSalle Hotel)*
ILLINOIS SECTION A.W.W.A. Sec'y, Dewey W. Johnson, 122 So. Michigan Ave., Chicago, Ill.

Mar. 18—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND SECTION A.W.W.A. Sec'y, Geo. G. Bogren, 14 Beacon St., Boston 8, Mass.

Mar. 18—Boston, Mass. *(Statler Hotel)*
NEW ENGLAND WATER WORKS ASSOCIATION. (Monthly Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

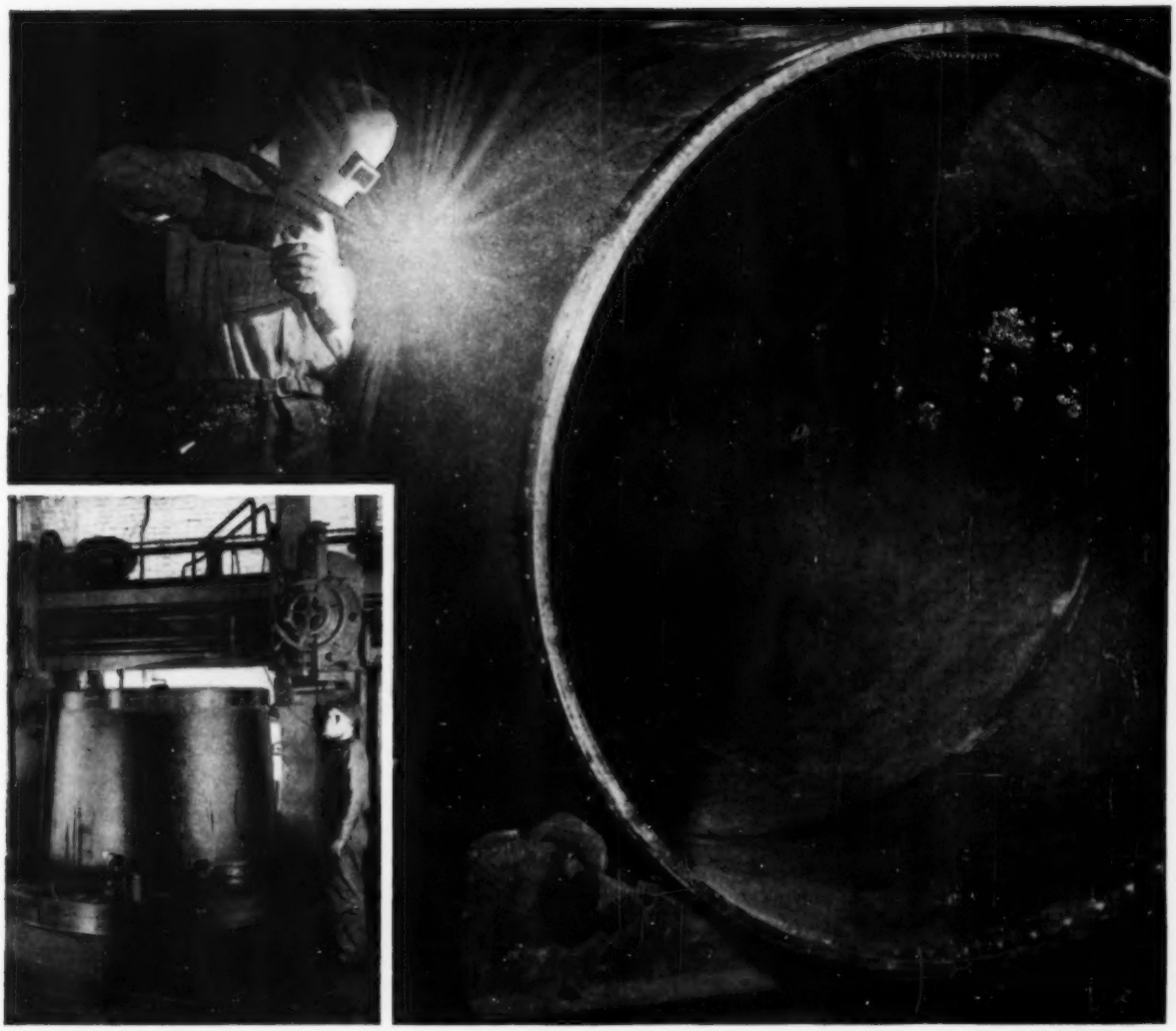
Mar. 18-19—Raleigh, N.C. *(North Carolina State College)*
THIRD SOUTHERN MUNICIPAL & INDUSTRIAL WASTE CONFERENCE. Conference Chairman, Dr. Nelson L. Nemerow, Dept. of Sanitary Engineering, N. C. State College, Raleigh, N.C.

Mar. 22-24—Little Rock, Ark. *(Marion Hotel)*
ARKANSAS WATER & SEWAGE CONFERENCE. Sec'y, Dr. Harrison Hale, Southern State College, Magnolia, Ark.

Mar. 29-31—Greenville, S.C. *(Poinsett Hotel)*
SOUTHEASTERN SECTION A.W.W.A. (25th Annual Meeting). Sec'y, N. M. deJarnette, 245 State Office Bldg., Atlanta 3, Ga.

Apr. 7-9—Emporia, Kan. *(Broadview Hotel)*
KANSAS SEWAGE WORKS ASSOCIATION. Sec'y, Dwight F. Metzler, State Board of Health, Marvin Hall, Room 2, Univ. of Kansas, Lawrence, Kan.

(Continued on page 82A)



TAPERED small-end Everdur section, before being welded to the large-end tapered section, is machined to fit the throat at C. H. Wheeler Mfg. Co., in Philadelphia.

YOU'RE LOOKING at the throat or intake end of the 2-section, 16-foot-long Venturi outlet cone. This throat is made by roll forming ⅝-inch Everdur-1010 plate at The Daniel Russell Boiler Works, Boston, Massachusetts. Here a seam is being welded by the Aircomatic® process. They are using Everdur-1010 Welding Rod.

This Everdur Venturi Tube Meters 350,000 gpm Through New York's Neversink Tunnel

Metering that much water flowing through the new Neversink Tunnel of New York's Delaware Water Supply System at 235 psi static pressure at cone requires an accurately fabricated, strong, corrosion-resistant Venturi outlet cone approximately 16-feet long with an 8-foot diameter tapering to 5 feet, 5 inches at the throat.

Obviously, such equipment, buried in the tunnel, must not fail – and Builders-Providence, Inc., the supplier, had to design to exacting specifications. But costs were also a factor. This huge cone was, therefore, designed for welded fabrication of ⅝-inch thick Everdur®-1010 (ANACONDA Copper-Silicon Alloy) plate.

This outstanding example typifies the virtues of Everdur for fabricating strong, corrosion-resistant equipment by the easy and economical methods to which it so readily lends itself. For, depending on the alloy, you can work Everdur hot or cold, and easily form, forge, weld and machine it. Everdur is available in plates, sheets, rods, tubes, electrical conduit and casting ingots. Our Technical Department's services are always yours for selecting the best and most practical material for your equipment. *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

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CORROSION-RESISTANT

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(Continued from page 80A)

Apr. 7-9—Emporia, Kan. *(Broadview Hotel)*
KANSAS SECTION A.W.W.A. Sec'y, Harry W. Badley, 119 West Cloud, Salina, Kan.

Apr. 12-14—Toronto, Ont. *(Royal York Hotel)*
CANADIAN SECTION A.W.W.A. Sec'y, A. E. Berry, Ontario Dept. of Health, Toronto, Ont.

Apr. 14—Norway, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Apr. 22-23—Watertown, N.Y. *(Woodruff Hotel)*
NEW YORK SECTION A.W.W.A. (Annual Spring Meeting. Registration evening of 21st). Sec'y, Kimball Blanchard, 50 West 50th Street, New York, N.Y.

Apr. 22-23—Lincoln, Neb. *(Cornhusker Hotel)*
NEBRASKA SECTION A.W.W.A. Sec'y, E. Bruce Meier, University of Nebraska, Lincoln, Neb.

Apr. 22-24—Tucson, Ariz.
ARIZONA SECTION A.W.W.A. Sec'y, M. V. Ellis, Supervisor Sewage Treatment Plant, Phoenix, Ariz.

Apr. 23-24—Bozeman, Mont. *(Baxter Hotel)*
MONTANA SECTION A.W.W.A. Sec'y, A. W. Clarkson, State Board of Health, Helena, Mont.

May 5-8—Sacramento, Calif. *(Hotel Senator)*
CALIFORNIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sam A. Weed, Room 315, City Hall, Oakland, Calif.

May 23-28—Seattle, Wash. *(Exhibits and Technical Sessions—Auditorium)*
AMERICAN WATER WORKS ASSOCIATION. (74th Annual Convention). Exec.-Sec'y, Harry E. Jordan, 521 Fifth Ave., New York 17, N.Y.
(All reservations will only be cleared through A.W.W.A. office).

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Write for bulletin 131

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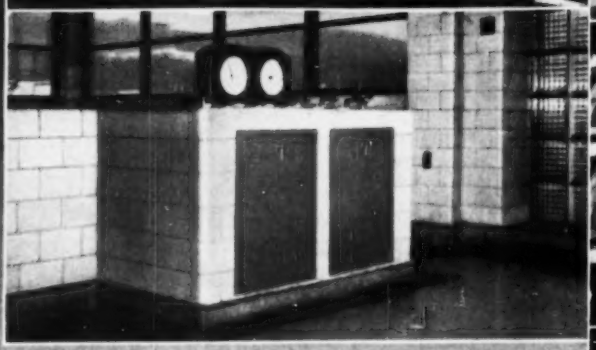
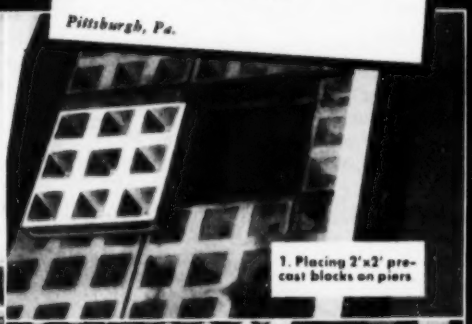
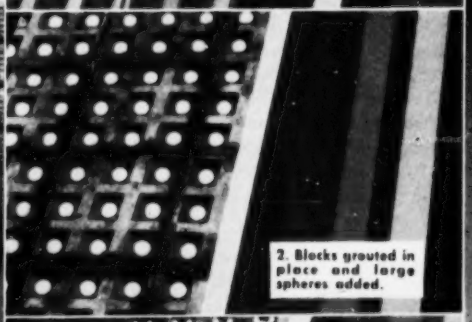




1. Placing 2'x2' pre-cast blocks on piers



2. Blocks grouted in place and large spheres added.

3. Completed Wheeler Bottom.

Located approximately 37 miles down the Ohio River from Pittsburgh, Midland must convert the highly variable Ohio River water with its tremendous volume of industrial and municipal wastes into a finished product of controlled pH, hardness, turbidity, taste and odor. Great flexibility of treatment, commonly found only in large plants, has been provided to handle values of pH as low as 5, hardness variation from 60 to 250 p.p.m., manganese from 0.5 to 1.3 p.p.m. and alkalinity from 1 to 33 p.p.m. The ingenious design and skillful operation of this 3 MGD Filtration Plant of the Midland Water Co. have given the community a completely satisfactory water.

Mr. James Danneker, Sup't., relies on high-accuracy Builders Controllers, Meters, and Gauges for dependable, efficient plant operation. The Wheeler Filter Bottoms, installed as pre-cast blocks, are another quality feature of the plant. For Bulletins describing Builders Water Works Equipment, address Builders-Providence, Inc. (Subsidiary of B-I-F Industries, Inc.), Providence, R. I.

Builders Equipment Furnished:

Model RCE Filter Rate Controllers

Model GA71-1R Loss of Head Indicating and Rate of Flow Recording Gauges

14" Venturi Tube with Type M Totalizer-Indicator-Recorder

Filter master control from clearwell level

B-I-F INDUSTRIES **BUILDERS** BUILDERS

PIONEERS IN METERS AND CONTROLS

Los Angeles Water Dept. Income and Consumption Are Increased

To keep ahead of the increasing water demands of fast growing Los Angeles, a total of $21,169,426 was expended for additions, extensions, and improvements to the city's water works, according to the annual report and financial statements of the Dept. of Water and Power for the fiscal year ending June 30, 1953.

The total income of the city's water system for the fiscal year was $22,583,291, an increase of $2,105,741 over the previous year. Operating costs were $12,523,568, and $6,298,184 was applied to interest on indebtedness and to depreciation.

The net income was $3,761,539, of which $1,005,215 was tranferred as a contribution to the general fund of the Los Angeles city government and the remainder applied toward retirement of bonds and to pay in part for the big program of construction of new water facilities.

The part of the construction program which was not met out of current income was financed by borrowing money through the issuance of water revenue bonds, which will be paid off by future water system revenues.

The increasing demand for water in Los Angeles was reflected in an 11% rise in the use of water as compared with the previous year, the largest increase on record with the Los Angeles water system. A total of over 17,700,000,000 cubic feet of water was sold during the year to an average of over 473,000 customers, according to the report.

Abrasive Prevents Pelletizing Los Angeles Sewage

According to press reports, City Engineer Lloyd Aldrich has graphically described to the Los Angeles City Council the perils of pellitizing sewage sludge for fertilizer. The Council voted to approve an ordinance terminating a previously written contract for providing this form of sludge.

The City Engineer declared that after $141,000 had been spent for pelletizing equipment of various kinds it was discovered that a strange abrasive was present in the local sewage sludge which as yet has not been identified, but which defeated the pelletizing attempts.

Knives and dies costing from $50 to $500 a set lasted from two to four hours before they were rendered useless.

On the brighter side the City Engineer declared that up to date $208,603 worth of unpelletized fertilizer from the Hyperion treatment plant has been sold and that sale of the flour-like fertilizer was being continued at a price of $7 a ton sacked and $4.05 unsacked. Aldrich said the city made a profit of 25 cents more on the unsacked material.

Water Barrier Experiment Success is Indicated

A progress report has been made of tests pointing to the success of the $750,000 fresh water barrier experiment at Manhattan Beach, California. The project is sponsored by the West Basin Water Assn.

Showings already made by test wells since the project was opened

(*Continued on page* 86A)

A SPECIAL ORDER for CHICAGO!

Flexible SALES CORPORATION

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(DISTRIBUTORS IN PRINCIPAL CITIES)

The City of Chicago recently required 14 special type bucket machines with "height extensions", allowing the load to be emptied directly into the dump truck. "Flexibles" was its choice. Pictured above are these "made-to-order" machines just prior to leaving the Flexible plant in Lima, Ohio. We have, or can "tailor", equipment required to meet your city's special needs. Write for FREE CATALOG.

AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS AND EQUIPMENT

Good water at lowest cost

Layne can help you get it

For 70 years Layne has been planning and producing efficient, economical, dependable water supply systems for municipalities, industries and farms. Layne perfected the gravel wall well. The Layne factory has produced a superior vertical turbine pump and well screen. New methods and materials are constantly being developed and proven in the laboratories of the Layne Research Division, the only organization of its kind in the world.

Undivided responsibility

When you let Layne develop or increase your water supply you save money because Layne does the whole job. From initial surveys and test drillings to completed water system and maintenance service through the years you deal with only one organization. Layne gives you dependable, economical, undivided responsibility.

World-wide experience

Our world-wide experience can be of benefit to you . . . in developing a new water supply . . . in extending your present system . . . in achieving greater production through overhaul of your existing system.

Consult your nearest Layne Associate Company or write Layne & Bowler, Inc., Memphis 8, Tenn.

Layne

Water Wells

Vertical Turbine Pumps

Water Treatment

Layne Associate Companies Throughout The World

(*Continued from page 84A*)

six months ago reveal fresh water tables above sea level in wells on the landward side of the fresh water barrier with saline content well below the average.

Test wells on the seaward side of the barrier continue to show almost pure sea water, the report shows. Initial expenditure for the test is from a legislative appropriation.

Raritan Valley (N. J.) Project Contracts Awarded

According to a recent announcement the Middlesex County Sewerage Authority has signed contracts for the design and supervision of work on the $22,500,000 Raritan Valley, New Jersey, trunk sewer.

Fees totaling $831,900 will go to four engineering firms under the contract. These are Metcalf & Eddy of Boston, Charles J. Kupper of New Market, Elson T. Killam of Short Hills and Bogert & Childs of New York.

Metcalf & Eddy will be the supervising engineers to design the treatment plant and the two-mile-long outfall into Raritan Bay.

Kupper and his associates will design the main trunk sewer from Bound Brook and Sayreville; Killam will draft plans for the force main from the pumping station to the treatment plant near Sayreville and Bogert & Childs will design the South River interceptor line and the main pumping station.

DOES IT control chlorine gas in the dry, non-corrosive state?

DOES IT meter chlorine gas with a true flow indicator?

DOES IT work the same winter and summer — without chlorine hydrate troubles?

DOES IT automatically prevent bothersome chlorine odors?

DOES IT have an easy-to-seal chlorine flow system free from stuffing boxes?

IS IT easily adapted to program or flow proportional control?

IS IT easy to understand and easy to operate?

IS IT low on maintenance?

Will your Chlorinating Equipment Pass This Test

Put Builders Chlorinizer to the test in your plant! See how this modern chlorine gas feeder answers every requirement for safe, reliable, low-cost, low-maintenance chlorination. Send for Bulletins 840-F1B, 840-J30, 840-J8. Builders-Providence, Inc., 350 Harris Ave., Providence 1, Rhode Island.

BUILDERS

IPC INDUSTRIES — PIONEERS IN METERS • FEEDERS • CONTROLS — BUILDERS

"NEVER MIND, -WATER DEPARTMENT, THE PRESSURES UP AGAIN."

Civil Defense Technical Manual on Operation and Repair of Water Facilities

The Federal Civil Defense Administration has published a 64-page Technical Manual titled "Operation and Repair of Water Facilities in Civil Defense Emergencies," which describes the operations, functions, and requirements of water utilities in such emergencies.

The manual is divided into two parts. Part I discusses the production and distribution of water for essential emergency demands, especially fire fighting. Part II is a description of the problems involved in maintaining the safety of the supply, including detection and identification of contaminants, as well as protective measures.

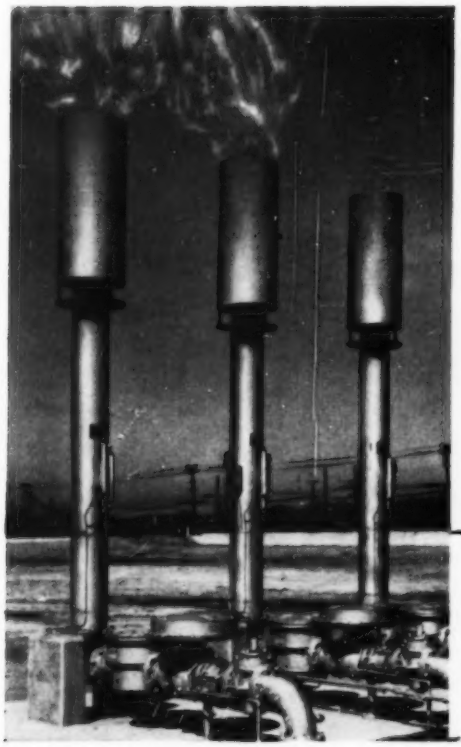
Credit is given to members of the FCDA advisory panel on water utilities for assistance in planning and review of the manual. These members are: Morrison B. Cunningham, Harry E. Jordan, Wendell R. LaDue, Dale L. Maffitt, and W. Victor Weir. The Public Health Service assisted particularly with those sections of the manual relating to contamination and its control.

Copies of the manual may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at 25 cents each.

In the East Bay Municipal Utility District plant at Oakland, California . . .

excess gas is safely burned with

P. F. T. WASTE GAS BURNERS



At this plant serving communities in the Bay area, three 95 ft. diameter digesters produce more gas than is needed for digester heating. To avoid resulting odor nuisance, East Bay's engineers have had three P.F.T. 6″ Waste Gas Burners installed for safe, convenient elimination of excess gas.

For control and protection, each burner is equipped with a P.F.T. 4″ Pressure Relief Waste Gas Flame Trap, completely eliminating hazards.

In addition to this gas safety equipment, the following P.F.T. products are installed in the plant: 3 Floating Covers for the 95′ digesters; 3 Heater and Heat Exchanger Units (1,200,000 B.T.U./hr.); 3 Cover Position Indicators; miscellaneous gas control equipment.

Complete information and diagram of P.F.T. Gas Safety Equipment upon request—Bulletin 321.

Design / Engineers of East Bay
of plant by / Municipal Utility District

The P.F.T. Waste Gas Burner consists of a baffled burner pot mounted on top of an insulated pedestal. Burner pots are provided with adequate baffled air inlets to permit continuous operation of a gas pilot and provide for intermittent combustion of excess gas through a wide range of flows. The insulated pedestal minimizes formation of condensate and prevents freezing.

P.F.T.

PACIFIC FLUSH TANK CO.

Waste Treatment Equipment Exclusively Since 1893

4241 RAVENSWOOD AVE. CHICAGO 13, ILLINOIS

NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE N C • JACKSONVILLE • DENVER

Pollution Reference Material in P. H. S. Publications

Recently published by the U.S. Public Health Service are two very useful compilations of reference material. Titles are: "Handbook of Selected Biological References on Water Pollution Control, Sewage Treatment and Water Treatment" and "Selected Bibliography of Publications on Industrial Wastes Relating to Fish and Oysters."

These handbooks are designed for use by sanitary engineers, chemists, bacteriologists and other professional personnel responsible for water pollution control and other related problems. The first is divided into 41 separate sub-categories. Its references were selected chiefly for their availability and potential usefulness to those who, though not trained primarily in biology, are faced with certain biological problems in the course of their professional work. In addition to the selected bibliographies, it contains three plates designed to aid in organism identification.

In the second publication the references on industrial wastes are divided into 22 categories for easy reference. Although supplies are limited, technical personnel may obtain copies upon request to the Division of Water Pollution Control, U.S. Public Health Service, Washington 25, D.C.

NEW...DIFFERENT...

PLASTIC BASE JC-60
CUTS SEWER SYSTEM COSTS

THESE ARE THE FACTS: JC-60® cuts sewer line *maintenance* costs. Joints poured with ATLAS JC-60 resist the common causes of sewer joint failure — root penetration, climate extremes, normal settling, loss of adhesion and chemical attack.

Operating costs go down. By reducing infiltration of soil water, JC-60 sewer joints reduce pumping costs and equipment capacity required at the disposal plant.

Installation costs go down. JC-60, with minimum shrinkage, high fluidity and resistance to overheating deterioration speeds the entire jointing procedure and minimizes material waste.

Years of ATLAS research created this remarkable new jointing compound. Based on a synthetic plastic, JC-60 is designed specifically to provide those characteristics proved most desirable in actual use.

COMPLETE FACTS are in Bulletin M20-3 and other technical literature. *Write for your copies.*

OTHER ATLAS JOINTING MATERIALS *include* **GK®** *and* **SLIPJOINT GK®** *for sewer pipe:* **MINERALEAD®** *and* **HYDRORINGS®** *for cast iron water pipe.*

ATLAS JOINTING COMPOUNDS
. . . a permanent bond

ATLAS MINERAL PRODUCTS COMPANY — MERTZTOWN, PENNSYLVANIA

Engineering Representatives Throughout the United States

Pickups from Purdue's "Sanitary Engineering News"

Don E. Bloodgood, Editor

To paint damp water pipes, first use a turpentine wash to displace the moisture on the pipes—then paint.

* * *

A report from Florida indicates that they have found that trickling filters four feet in depth are satisfactory in that State.

* * *

The June issue of the Journal of the AWWA gives a rate analysis report of 416 cities. The highest cost for 1000 cubic feet of water is $5.24 in Staunton, Virginia, and the lowest cost for the same amount is 60c in Chicago, Ill.

* * *

Jacksonville, Florida, with a population of 204,000, plans to obtain 125 m.g.d. of water from artesian wells 1100 to 1300 feet deep. They are putting down 44 new wells.

* * *

Indianapolis Water Company has let a contract for the construction of an impounding reservoir on Cicero Creek. Total cost of the whole project is approximately $8-million.

* * *

Keefer reports on tests where he added 25 p.p.m. of chlorine to raw sewage and found a residual in the liquid after six days.

* * *

From *Steel* by Washington editor, E. C. Kreutzberg, "Makers of equipment for sewage and industrial waste treatment are getting one-third to one-fourth the business they should on the basis of need."

* * *

The University of Florida is planning a series of correspondence courses in sanitary engineering for the water and sewage plant operators.

* * *

Two parts of Calgon mixed with one part of soap or synthetic detergent in 1% water solution successfully removes radioactive contaminant from most surfaces.

* * *

A rapid method for BOD determination, using high concentrations of organisms, is being studied at the University of Florida.

YOU CAN *Specify* MINIMUM MAINTENANCE COSTS WITH *Amercoat* PROTECTIVE COATINGS

ONLY AMERCOAT PROVIDES YOU WITH

The most complete line of corrosion resistant coatings available anywhere

Field service backed by an organization SPECIALIZING in corrosion control

The service life of your equipment—the efficiency of your production schedules — the ultimate value of your investment and maintenance dollars — all are vitally dependent on the continuing performance of the protective coatings specified in your plant. Thus, success or failure of your coatings can mean the difference between tremendous losses or substantial savings.

To assure coating performance that provides long-lasting, low-cost protection, two steps are absolute essentials, right from the start. You need the right coating for each specific exposure, and it must be applied properly if it is to yield maximum benefit.

AMERCOAT ELIMINATES THE GUESSWORK—MINIMIZES MAINTENANCE COSTS

First of all, AMERCOAT provides the right coating for the particular problem. From the complete AMERCOAT line, it is possible to provide specific coatings for specific exposures to achieve specified protective performance.

In addition, you receive the added value of AMERCOAT's conscientious service follow-through backed by an organization SPECIALIZING in industrial corrosion control. With the assistance and on-the-spot advice of a trained representative, you get the best possible application through proper attention to surface preparation and correct coating techniques.

Investigate AMERCOAT now. It's your surest way to effective, long-term corrosion control. An experienced representative is near you to serve you. For complete details write today.

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HOUSTON, TEXAS

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

M. S. Univ. and East Lansing an Example of Joint Planning

Joint planning between one of America's leading universities and the community in which it is located has produced results of mutual advantage. Nearly a half-dozen major projects—including fire and police protection, and sewage and garbage disposal—are being operated on a "50-50" basis by Michigan State College and the community of East Lansing.

Outstanding among these co-operative services is the $500,000 sewage disposal plant which serves both the college and the city. The capital investment was shared by the city and the college on a 50-50 basis. In addition, the college and the city share the annual maintenance and operational budget which totals about $42,000 a year. This is divided on a use basis with the college paying about 65 per cent and the city 35 per cent.

In event of water failure in either the city or the college, one system can furnish water to the other's system through a connection set up on a co-operative basis. Each has its own wells and water system but the two systems are joined with a valve and meter. A small but important project is that of testing the city's water supply by the college's department of bacteriology at a cost to the city of $150 a year.

Reclaimed Sewage May Serve for Farm Irrigation

A critical shortage of water for farm irrigation in the coastal area of California's southwest Orange County may be solved by the use of reclaimed sewage. Fresh water wells in the vicinity are fast becoming contaminated with salt water.

Officials of the Joint Outfall Sewer District, city of Santa Ana, Orange County Water District and State agencies pledged co-operation with the move by farmers which probably will require formation of an irrigation district to handle the distribution.

It was estimated the farmers can count on about 3,000,000 gallons of reclaimed water a day from Santa Ana, Anaheim and Orange sewage. The effluent from the three cities would be made available at the old treatment plant when the new plant and trunk line are completed.

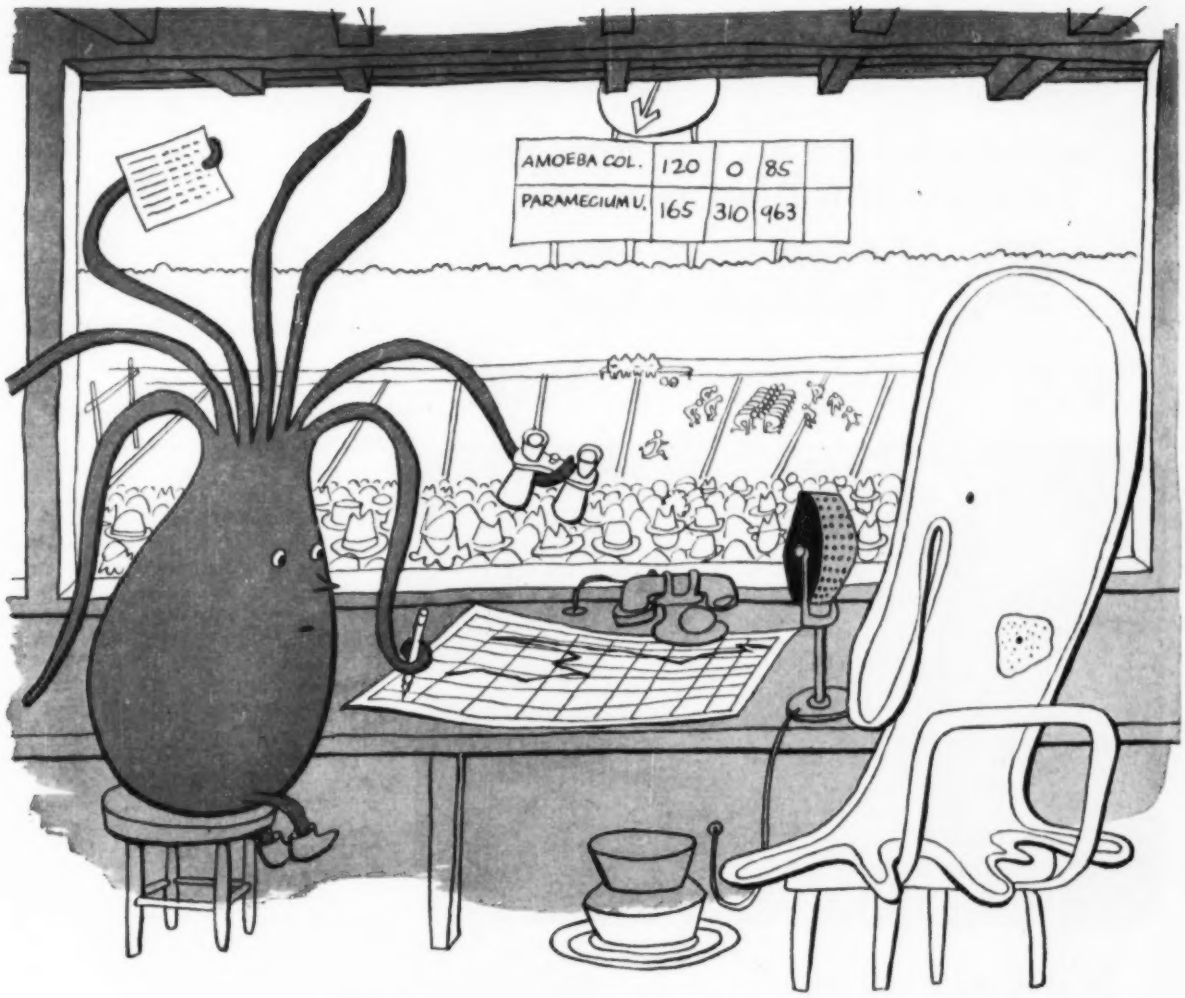
Waste water disposal from oil fields and refineries which at present ruins the sewage water for crop irrigation will be run through the trunk and into the new plant.

The tentative plan calls for reclaiming about 15,000 acre-feet of water yearly and turning off the Talbert area pumps, thus maintaining a form of fresh-water barrier against salt-water encroachment under the coastal shelf.

Sewage Treatment Plants Increase in Second Quarter of 1953

During the second quarter of 1953, municipalities awarded contracts for 204 projects to abate water pollution and conserve water resources, according to a statement issued by the Public Health Service of the Department of Health, Education, and Welfare. The $64.6 million represented by these public sewage treatment plant projects was more than double the amount for the preceding quarter's contracts, and 55 percent greater than that reported in the corresponding 1952 period. Of the 204 projects, 118 are new plants, costing $45.3 million, and 86 are additions, enlargements, or replacements, costing $19.3 million.

MH
MECHANICAL JOINT
Cutting-in SLEEVE
Easy, Quick, Economical
Valve Set in Line
Joint Completed
This M & H mechanical joint Cutting-In Sleeve makes it easy to install a mechanical joint or a hub end gate valve or pipe fitting into an existing pipe line. Out of the pipe line cut only a length of pipe equal to the over-all length of the valve or fitting to be installed, plus 9 inches. The mechanical joint Cutting-In Sleeve is then telescoped over one of the cut ends, the valve inserted into position and the Sleeve pushed back to socket into the valve bell. The joint is then bolted up if it is mechanical joint valve, or poured and calked if hub end valve. For complete information, write or wire M & H Valve and Fittings Company, Anniston, Alabama.
M&H PRODUCTS FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION



"Better warn the listeners, Orgie,
to watch out for® **PITTCHLOR**"

Yes, sir, Orgie, you'd better give that commercial often if you want your bacteria friends to listen in on future games.

Pittchlor, the high-test calcium hypochlorite containing a minimum of 70% available chlorine, is lethal to chlorine-susceptible bacteria and algae. It kills these microorganisms on contact. It works fast and effectively in chlorinating water supplies, treating sewage, and wherever the germicidal and deodorizing action of chlorine is needed.

Pittchlor is dry, white and free-flowing. Its granular form permits ease of application either manually or by mechanical feeders. Write for free folder on the use in which you are interested.

FOR
WATER PURIFICATION
SEWAGE TREATMENT
SWIMMING POOL
SANITATION

Stocked by leading jobbers in 5 lb. resealable cans (9 per case), 3¾ lb. cans (12 per case) and 100 lb. and 130 lb. drums.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
ONE GATEWAY CENTER, PITTSBURGH 22, PENNSYLVANIA

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Push-button Muscle

The tough little brute of a work-saver when you've got pipe to thread, cut or ream

RIDGID

"400" Portable POWER-DRIVE

It's light weight!

Portable Stand

● The last word in easily portable power to turn your pipe for threading, cutting, reaming with your hand tools—quickly pays back its cost in saved time and work. Capacity ⅛" to 2" but scads of power even for geared tools to 12". RIDGID design 3-jaw chuck, 6 pinions, one always handy. Self-centering workholder in rear. Sealed-in lubrication—no oil to spill. Famous RIDGID "guts" in it—scores of thousands in use. Try it, buy it—at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID

Work-Saver Pipe Tools

Former "P.D.M." Tank Erector Offering Tank Repair and Maintenance Service

John P. Shields, who for a number of years was in the employ of the Pittsburgh-Des Moines Steel Co. of Pittsburgh, Pa., and Des Moines, Ia., which he served at one time as tank inspector, erector and repair supervisor, is now offering a tank repair and maintenance service of his own. This fact we have just recently learned of, although Mr. Shields began his tank service business about 18 months ago.

In answer to our inquiry Mr. Shields tells us that his experience in tank inspection, erection, repairing and painting dates back 11 years to 1942. Based on such experience he enjoys reference of work to him by his former employers which, to us, is a decided recommendation.

Mr. Shields operates as the Virginia Erection Co., of Rochester, Pa.

Robert S. Phillips Joins Omega Machine

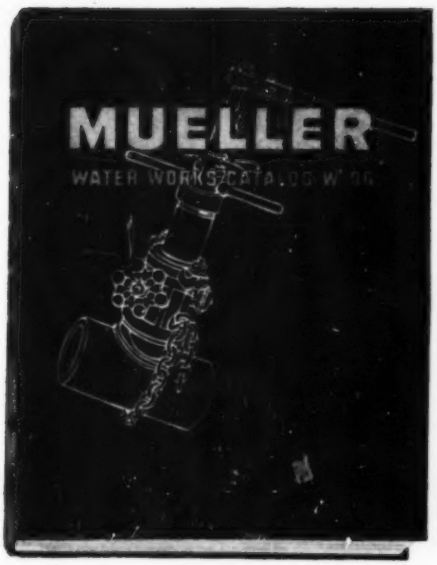
Omega Machine Co., Providence, R.I., has announced that Robert S. Phillips has joined the Company as a Project Engineer, specializing in the Water Works and Sewage Fields. Mr. Phillips is well known in this field. He is a past Secretary-Treasurer of the North Carolina section of the A.W.W.A.; a past Director of the North Carolina Sewage Works Association; and a past President of the North Carolina Water Works Operators Association.

Mr. Phillips comes to Omega from the City of Charlotte, North Carolina, where he was superintendent of both the Water and Sewage plants. During the Korean War, Mr. Phillips served in the United States Army and was assigned to the Surgeon General's Office, Army Environmental Health Lab. where he did research on the disposal of T.N.T. waste. He has also served as Chief Chemist at the City of

(*Continued on page* 94A)

MUELLER®

Have you received your New W-96 Water Works Catalog?



The new Mueller Water Works Catalog is now off the press and its distribution has almost been completed. If you have not received your copy, please drop us a note — Dept. A-36, Mueller Co., Decatur, Illinois.

Catalog W-96 . . . 328 pages . . . the complete line of Mueller Water Works Distribution Products and useful engineering information.

MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

(Continued from page 92A)

Durham, North Carolina Water Department. Among the awards which have been conferred upon him are the Kenneth Allen Award in 1943, and the Fuller Award in 1950.

25-H.P. Variable Speed Drives

1201

Link-Belt, Chicago, Ill., has announced the availablity of P.I.V. positive, infinitely variable speed drives in two new types for 20 to 25 horsepower applications.

In addition to the basic H-6 P.I.V. of 25-horsepower capacity, Link-Belt can now supply an HG-6 drive, furnished with either a single reduction input or single reduction output helical gear attachment or an HGG-6 drive, furnished with both a single reduction input and single reduction output helical gear attachment.

Input gear reductions are available from 1.93:1 minimum to 5.82:1 maximum, and output gear reductions from 1:1 to 6.33:1. Speed increasing gear sets are also available.

The complete Link-Belt line includes P.I.V. drives in eight sizes, ranging from ½ to 25 horsepower capacity, with ratios up to 6:1, in 16 types, for horizontal and vertical mounting, with and without helical gears and integrally mounted motor.

Col. Rockwell Returns To Company

Rockwell Manufacturing Co., has announced that Col. Willard F. Rockwell, who has resigned as Assistant to Secretary of Defense Charles E. Wilson, has returned to his position as chairman of the board of directors.

Colonel Rockwell's resignation to Mr. Wilson was submitted in mid-September after he had made his final report following a three-week tour of North Atlantic Treaty Organization member countries.

The tour—his third for the Defense Department this year—was made for the purpose of inspecting principal sources of munitions supply for the NATO nations. Colonel Rockwell joined the Defense Department last April 1 at the request of President Eisenhower and Secretary Wilson.

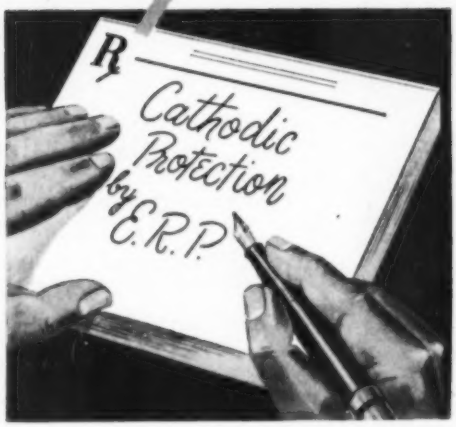
His task was to convert the Army and Navy Munitions Board into the new office of Assistant Secretary for Supply and Logistics—an assignment he completed by July 1.

H. T. Judson of Hersey Meter Dies

Hersey Manufacturing Co., Boston, Mass. has announced the death of Harlow T. Judson, Manager of the company's Portland, Oregon branch, on September 24.

Mr. Judson had been associated with the company since 1927. Born at Cannonsburg, Michigan in 1885, he was graduated from the Grand Rapids High School in 1903. Upon graduation he entered the employ of the Wolverine Brass Works, with whom he remained until 1912 when he became associated with the Standard Oil Co. of New York and was sent by them to China as a structural engineer. He returned to the United States in 1920 and in 1927 entered the employ of the Hersey Company.

R FOR CORROSION...



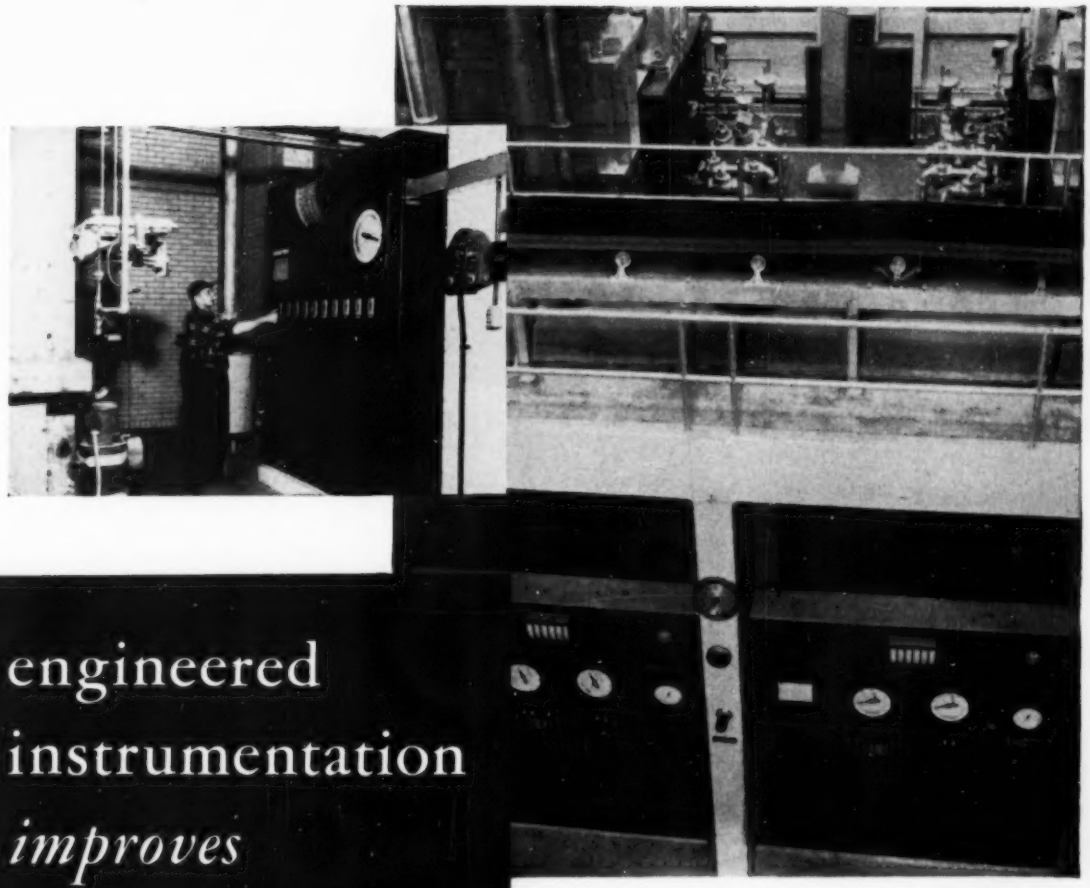
You don't need a specialist to *recognize* Corrosion. But you do need one to treat it successfully. The skill required to achieve complete corrosion control comes only from the knowledge and experience gained through years of practical application.

Recognition of that fact is one reason more and more people are turning to E.R.P. for assistance on corrosion problems — one reason that thousands of buried or submerged steel structures of all types have been completely protected against corrosion by E.R.P. engineers. Corrosion specialists *for over 17 years*, these men are highly trained and well equipped to help you with *your* corrosion problem. Write for full information today.

COMPLETE CATHODIC PROTECTION SERVICE • DESIGN ENGINEERING MAINTENANCE INSTALLATION EQUIPMENT

ELECTRO RUST-PROOFING CORP. (N. J.)
BELLEVILLE 9, NEW JERSEY
REPRESENTED IN PRINCIPAL CITIES IN THE UNITED STATES

E-27



engineered instrumentation *improves sludge disposal*

Portion of the control panel for the four flash dryers at the big Hyperion plant, Los Angeles, is shown at the right above. At left, a much smaller plant at Bethlehem, Pa., benefits from similar instrumentation.

MODERN SYSTEMS for sludge drying and incineration are profiting by the application of the same principles of Honeywell engineered control as other phases of waste-treatment plants. In many C-E Raymond Systems, built by Combustion Engineering, Inc., flash drying and incineration are accomplished with maximum efficiency under the guidance of Honeywell controls.

These systems, and the control that is an integral part of them, are not confined to a few big plants. You'll find them working from coast to coast, on installations ranging in capacity from 1 to 200 tons per day. And in each, Honeywell controls lend valuable assistance in reducing labor and operating costs, eliminating damage from overheating . . . generally improving efficiency of dryers which convert sludge to a saleable product . . . or minimizing the discharge of objectionable gases and ash from incinerators.

Like any other modern process, sludge dryers need only the instrumentation that extensive engineering experience indicates is necessary. This usually consists of a multipoint *ElectroniK* instrument for recording stack, air and gas temperatures . . . and an *ElectroniK* pneumatic controller for regulating fuel, oil, or gas flow. This system, individually engineered for each job, has been incorporated into projects designed by many of the most prominent consulting firms.

Your local Honeywell engineering representative will be glad to discuss instrumentation for any waste treatment application with you and your consulting engineer. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4575 Wayne Avenue, Philadelphia 44, Penna.

● **REFERENCE DATA:** Write for Bulletin 7302, "Instrumentation for Water, Sewage, and Industrial Waste Treatment".

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

RIDGID

Is Work-Tested . . .

Before It Leaves the Factory

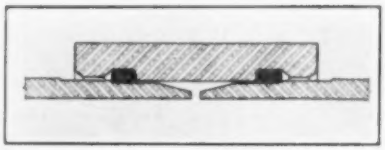
. . . to make sure it gives you the Best and the Most wrench service for your money

The reason RIDGID Heavy-Duty Pipe Wrenches are known for the brutal punishment they can take is because of the toughness built into them, checked part by part and then hard work-tested when assembled . . . not just one wrench in 100 or 1000 but *every last one!* . . . Add the guaranteed repair-free housing, no-slip no-lock jaws, handy pipe scale, easy spinning adjustment nut and comfort-grip I-beam handle and you see why genuine RIDGID gives you the big value for your money. Buy them at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID

Work-Saver Pipe Tools



New Coupling for Transite Pipe

1202

Johns-Manville, New York, N.Y., has developed a new coupling for use with Transite pressure pipe. Called Ring Tite, it can cut down expected installation time radically since the coupling automatically centers, aligns and provides for expansion. Furthermore, it can be quickly assembled even under adverse trench conditions.

Up to now the Simplex Coupling has been the standard recommendation for underground pressure lines of asbestos-cement pipe. It consists of a sleeve and two rubber rings.

The new Ring-Tite coupling is made up of the same elements but the sleeve of Transite and the ends of the Transite pipe are of a different design.

The sleeve has two grooves cut circumferentially into the inner wall. These grooves locate the rings accurately and firmly hold them in position.

To go with this sleeve, the ends of the pipe are specially machined to provide an entering taper back of which is a two-step machined area. The taper makes it easier to insert the pipe. The shoulder between the two steps provides a stop which halts movement as the pipe, rubber rings and Transite sleeve slide together.

When the rubber rings contact the stop shoulder the assembly is completed. The rings are equidistant on either side of the joint. Space for expansion has been left between the pipe ends. The lengths being joined have been brought into alignment. The rubber rings, locked firmly in their grooves, are tightly compressed between the sleeve and the pipe.

Robertson Elected V.P. of Armco Drainage

Armco Drainage & Metal Products, Inc., Middletown, Ohio, has announced that William O. Robertson, manager of the Eastern Division has been elected a Vice President of the company.

Robertson's Armco career began in 1929, when he joined the Ingot Iron Railway Company, an Armco subsidiary. During the next ten years he

(*Continued on page* 98A)

In 24 of America's large cities and scores of smaller towns, Rensselaer valve equipment has been used satisfactorily for 50 years or more.

Such records of performance and repeat orders cannot be accidental. They are due to the fact that all Rensselaer products are over-safe, both as to generous amounts of materials in the right places, and the incorporation of design features which insure reliable performance years after the valves are installed.

103

Rensselaer VALVE COMPANY, TROY, N.Y.

GATE VALVES • FIRE HYDRANTS • SQUARE BOTTOM VALVES • CHECK VALVES • AIR RELEASE VALVES

SALES REPRESENTATIVES IN PRINCIPAL CITIES

(*Continued from page 96A*)

served in several capacities with this group, as well as with the Drainage Engineering Company.

In 1939, he was transferred to the Armco Railroad Sales Company, Inc., as manager of the eastern district. His first assignment with Armco Drainage & Metal Products came in 1943, when he was made assistant manager of the contracting division.

In 1945, Robertson became manager of railroad sales for the Philadelphia district, and the following year was appointed sales manager of the Eastern Division of Armco Drainage & Metal Products.

He was made manager of the Eastern Division early in 1953, and will continue to hold that post in addition to his responsibilities as a Vice President of the company.

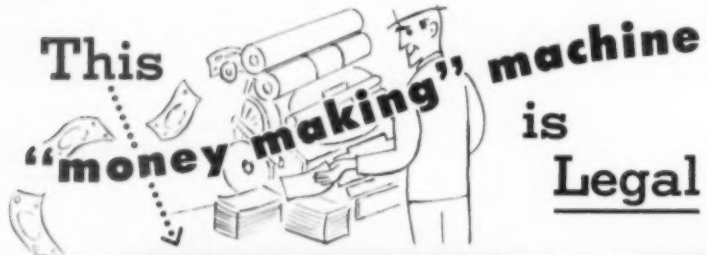
Metal Faced Panels for Building Pumping Stations, etc.

1203

The Clements Panel Co., New York, N.Y., has developed Metal-Faced Modular Panels for the construction of water and sewage pumping stations, buildings, laboratories and walk-in incubators.

This product consists of an integrated modular system of ready-to-install units for load-bearing or curtain walls and partitions, flat, arched or pitched roofs, and floors. The panels are accurately factory made and are adaptable to an unlimited range of design and performance requirements.

The panel is a hollow plywood shell, filled with an efficient insulation, covered on both faces with a metal "skin" laminated to the plywood. This method provides units having structural strength in impact, deflection, compression and bending for use as load bearing or curtain members. It also provides effective insulation and a vapor barrier on both sides and metal surfaces that can be left as the finish or painted.



Here is a machine that will literally "Make Money" for you. Sludge cake direct from the drying beds, with moisture content as high as 56%, is fed into the low hopper of the Royer Sludge Disintegrator and a completely pulverized, mixed and aerated product is discharged to bag, pile or truck. Florists and nurserymen, gardeners, mushroom growers and golf courses furnish a ready market for this valuable, easy-to-apply fertilizer. As an additional "money maker" you eliminate the cost of doing away with your sludge by incineration or burial.

Send for a copy of our Sewage Sludge Datalog containing detailed information on all models of the Royer Sludge Disintegrator—available in electric motor, gasoline engine or belt-to-tractor drives. It will pay you to investigate.

ROYER

PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.

170 PRINGLE ST. KINGSTON, PA.

Bristol Appoints Ernest Nuber Sales Manager

The Bristol Company, Waterbury, Conn., has announced that Ernest Nuber has been appointed sales manager, instrument division.

Mr. Nuber joined the Bristol sales engineering organization in 1929. He was made Pacific Coast Manager in 1934 and later served for several years as Export manager. In 1948 he was promoted to the position of Manager, Application Engineering Department.

Mr. Nuber will continue to maintain his headquarters at the company's main office at Waterbury, Conn.

Marlow Pumps Merges With Bell & Gossett

Marlow Pumps, Ridgewood, N. J., manufacturer of self-priming centrifugal pumps, has merged with the Bell & Gossett Company, Morton Grove, Illinois, manufacturers of hot water circulating pumps, universal pumps, heat exchangers, flow control valves and other heating specialties. According to the announcement by A. S. Marlow, Jr., President, the joining of Marlow with Bell & Gossett makes the new combination one of the largest of its type in industry.

(*Continued on page 100A*)

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WATER & SEWAGE WORKS READER SERVICE

READER SERVICE CARDS HOW TO USE THEM

Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.

Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.

Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

there's nothing SECRET about Threshold Treatment with CALGON*

THE STRAIGHT STORY about Threshold Treatment with Calgon goes like this to users of municipal and industrial waters:

THRESHOLD TREATMENT WITH CALGON

1. Prevents lime scale
2. Controls corrosion
3. Stabilizes dissolved iron and manganese
4. Stabilizes water following softening

The treatment is simple, effective, economical. Write us a letter and tell us your municipal and industrial water problems.

HAGAN
HALL
BUROMIN
CALGON

calgon, inc.

A SUBSIDIARY OF HAGAN CORPORATION
HAGAN BUILDING, PITTSBURGH 30, PA.

*T.M.Reg. U.S. Pat. Off.

(*Continued from page* 98A)

Marlow Pumps, with its main plant in Ridgewood, N. J. and a branch plant in De Queen, Arkansas, as well as licensed plants in France and England, will continue its present line under the Marlow name. Additional production capacity will be added in the east to manufacture Bell & Gossett's products. Both product lines retain their individual identity throughout sales, marketing and distribution.

Under the new set-up, Marlow Pumps will be known as the Marlow Division of Bell & Gossett and will be headed by A. S. Marlow, Jr., as General Manager. He will also be a Vice President and a member of the Board of Directors of Bell & Gossett.

Sewer and Drain Cleaning Machine

1204

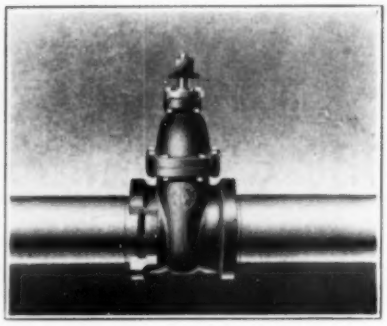
Ohio Tool & Engineering Company has developed a new Sewer and Drain Cleaning Machine that, by means of an entirely new and unique principle of cable construction, is able to completely eliminate helixing and loss of cable in the line.

The cable consists of a large diameter, heavy, spaced outer coil (wound right hand) and a close wound, music wire coil of substantially smaller diameter (wound left hand) which is inserted inside the larger coil. The two coils are tied together at each end to form an integral driving member.

When extreme torque is applied, the outer coil tends to increase in diameter while the inner coil tends to decrease. One coil has a tendency to helix in one direction, the other in an opposite direction—thus balancing the forces causing the helix. Even under the most extreme torque, the cable is entirely flexible—and easily negotiates turns such as encountered in "P" traps.

Loss of cable is completely eliminated as each end of the inner coil is tied to its respective end of the outer coil. Even though one coil may break, the cable can still be pulled from the line.

Impact Insurance Against
1—LOSS OF FIRE PROTECTION.
2—EXCAVATION AND PAVEMENT REPLACEMENT.
3—COSTLY REPAIRS INVOLVING MAJOR HYDRANT COMPONENTS.
4—FLOODING.
The Smith Protectop Hydrant is designed to permit rapid return to service at minimum cost when a Hydrant is damaged as a result of a traffic accident
The Protectop Hydrant Standpipe and Valve Stem are equipped with Special Couplings located just above the ground. The Couplings withstand operating pressures and ordinary impact with an ample factor of safety. Under excessive impact occasioned by traffic accidents the Couplings fracture at the design points thus minimizing the damage and permitting speedy return to service at low cost
All Smith Hydrants are equipped with Compression Type Valves which definitely eliminate flooding since the line pressure holds the Valve against its seat in the closed position
Write for details
38
THE A.P. SMITH MFG. CO.
EAST ORANGE, NEW JERSEY



Gate Valves and Fire Hydrants For Transite Pipe

1205

The A. P. Smith Manufacturing Company, East Orange, N.J., is now supplying fire hydrants and gate valves with Ring-Tite joints for direct connection to Johns-Manville Class 150 Transite Ring-Tite Pipe.

No extra fittings, no extra labor, no extra joint materials are necessary for quick, easy installation in any weather, or in wet trenches and rough terrain.

Using Smith Fire Hydrants and Gate Valves with Johns-Manville Class 150 Transite Ring-Tite Pipe, crews simply pop rubber rings into grooves, lubricate pipe ends and slip pipe into the valve or hydrant connection until movement is stopped automatically by the shoulder of the pipe.

A very simple puller is provided so the installation is completed with a minimum effort.

At low pressures the seal is achieved by radial compression of the rubber rings. As pressure increases, it wedges

(*Continued on page* 102A)

Save More in '54

WITH HOMELITE CARRYABLE PUMPS and GENERATORS

Get them in now on your 1954 budget... new Homelite Pumps and Generators. You'll never regret it... for what you spend, you'll save many times over, in many different ways.

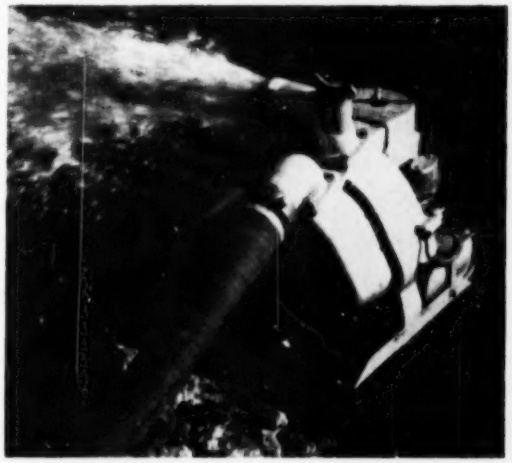
Homelite Carryable Pumps

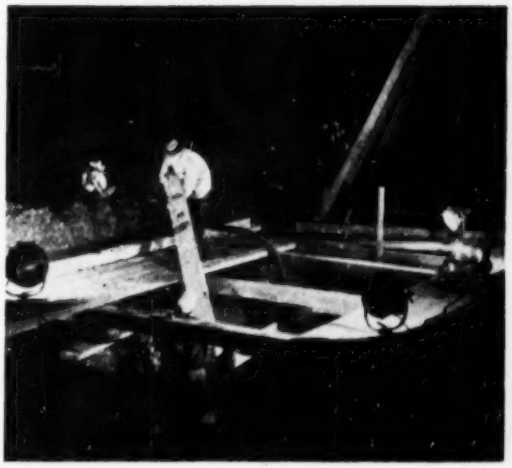
The most efficient pumps you can buy. No transportation problems. No labor problems. No pumping problems. Small enough to fit in the back of a car, a Homelite is easily carried and put into operation any place you need it by *one man only.* Starts instantly in any temperature. Has the fastest self priming. Its 28 foot suction lift is guaranteed. Handles up to 15,000 gallons per hour. Controls seepage, automatically. Non clogging... self scouring . . . foolproof . . . it's the most dependable, useful pump you could want.

Homelite Carryable Generators

They put light, they put speed on the job. Like Homelite Pumps, one man can get a Homelite Generator right where you need it, quickly and easily. One pull on the starter and you have power . . . plenty of dependable power to operate brilliant floodlights for night work or money saving power tools at all times day or night.

Write today for complete information or free demonstration of Homelite Pumps and Generators.





Manufacturers of Homelite Carryable Pumps • Generators Blowers • Chain Saws

PERFORMANCE · DEPENDABILITY · SERVICE

HOMELITE CORPORATION

712 RIVERDALE AVENUE • PORT CHESTER, N. Y.

Canadian Distributors: Terry Machinery Co., Ltd., Toronto, Montreal, Vancouver, Quebec.

(*Continued from page* 100A)
the rings tighter. The higher the pressure, the tighter the seal.

Smith Gate Valves with Ring-Tite Joints are now available in sizes 4" through 12" for use with Class 150 Transite Ring-Tite Pipe. Smith Fire Hydrants are available with Ring-Tite Connecting Joints for use with 4" and 6" Class 150 Transite Ring-Tite joint pipe. Lugs are furnished on the hydrant connecting joint to tie the hydrant to the main.

J. R. Thomas Joins Process Engineers

Process Engineers Incorporated, Los Angeles, California, has announced that Mr. J. R. Thomas, formerly with Kaiser Aluminum and Chemical Corporation, Spokane, Wash., has been appointed Manager of the Pittsburgh office of the company.

A graduate of the University of Pennsylvania, Mr. Thomas is returning to his home state after an absence of about ten years. Mr. Thomas and staff are located at 666 Washington Road, Pittsburgh 28, Pa.

Easily Applied Neoprene Formulation for Tank Lining

1206

Carboline Co., St. Louis, Mo., has announced that through special formulation, it is now possible to eliminate the 10 to 20 coat systems formerly required to line tanks with Neoprene. Brush coats 10 to 20 mils (.010"-.020") can be applied, so that 1/16" linings can be obtained with 4 to 7 coats. There is no loss of physical or corrosion resisting properties, and coatings cure at room temperature.

The heavy coat characteristic of the new product is combined with excellent pot life and a corrosion resistance comparable with heat-cured Neoprene.

Another new feature is the development of a primer called Neoprene 100 primer suitable for both sandblasted and wirebrushed rusty steel surfaces. The new primer is resistant to direct corrosion, creep corrosion, and provides excellent edge protection. The new Neoprene coating bonds to it perfectly. The primer can also be modified for application on damp surfaces.

C. L. Holbert

R. D. Cross

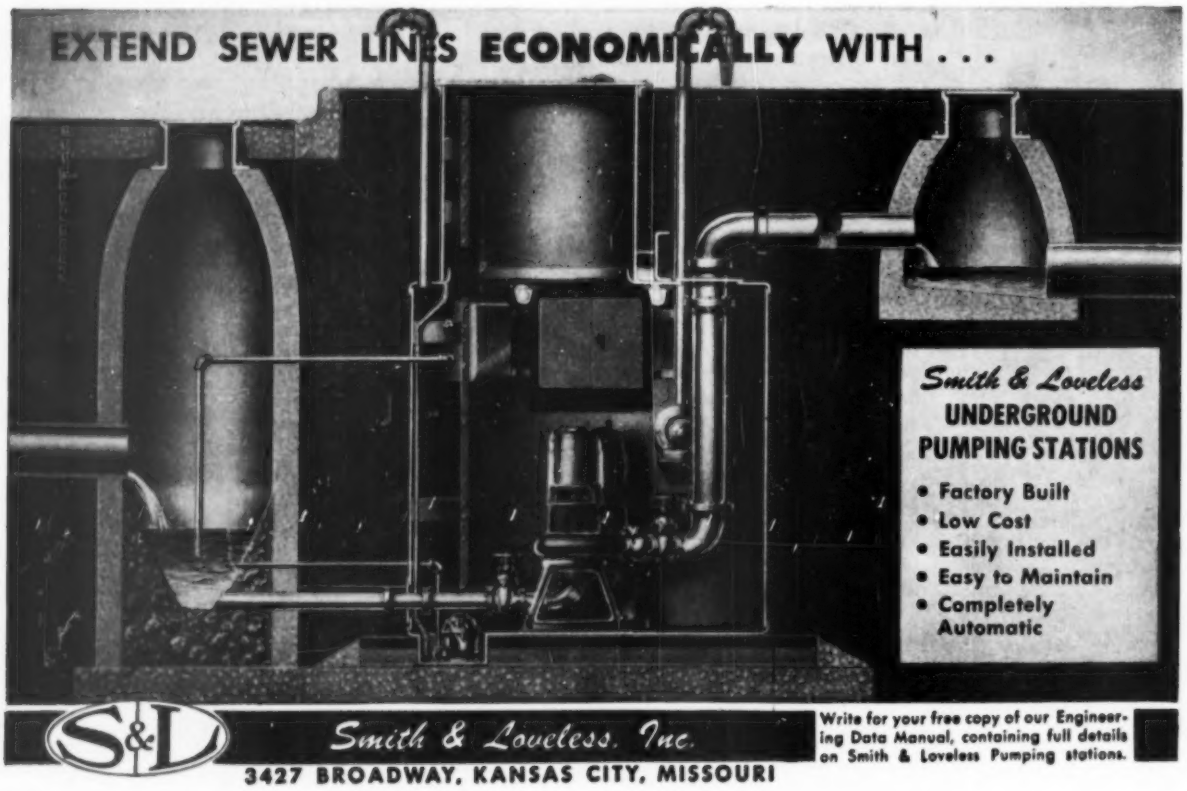
Johnston Pump Promotes Holbert and Cross

Johnston Pump Company, Pasadena, California, has announced that C. L. Holbert and Rex D. Cross have been appointed to new positions.

Holbert, formerly Vice-President-Treasurer, moves up to Vice-President-General Manager.

Cross, who was District Sales Manager, Southeastern States, takes over as National Sales Manager.

(*Continued on page* 104A)


EXTEND SEWER LINES ECONOMICALLY WITH . . .
Smith & Loveless
UNDERGROUND
PUMPING STATIONS
• Factory Built
• Low Cost
• Easily Installed
• Easy to Maintain
• Completely Automatic
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Smith & Loveless, Inc.
3427 BROADWAY, KANSAS CITY, MISSOURI
Write for your free copy of our Engineering Data Manual, containing full details on Smith & Loveless Pumping stations.

HAGAN Compensated Ring Balance Meters

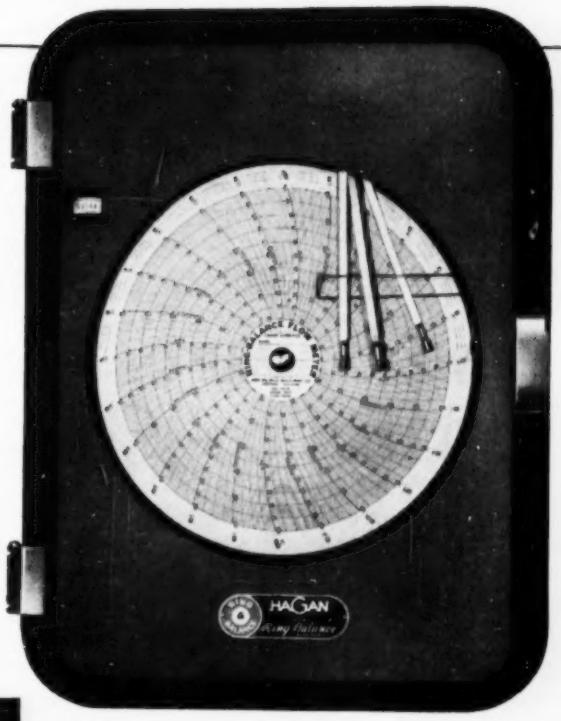
provide *accurate, automatic* compensation

- for *temperature*
- for *pressure* or
- for *pressure and temperature*

When you measure flow of liquids or gases, and pressure and temperature variations occur, there are two ways to correct meter readings — one by expensive and laborious clerical calculations, the other, by using the Hagan Compensated Ring Balance Meter in the first place. This Hagan Compensated Meter corrects *automatically* for variations in pressure, temperature, or pressure and temperature, and makes a chart record of both the corrected and the uncorrected flow. The built-in integrator totalizes the corrected flow automatically.

Dependable Hagan Ring Balance Meters are simple, ruggedly built, and designed for years of trouble-free service. Some features of Hagan Ring Balance Meters include:

- **Mercury level not critical**
- **Ease of dead-weight calibration**
- **No stuffing boxes or pressure-tight bearings**
- **High sensitivity at low flow rates**
- **Adjustable, full-scale range**



Whatever your metering problems, our engineers are at your service. For full information, phone, wire, or clip the coupon.

HAGAN CORPORATION

RING BALANCE FLOW AND PRESSURE INSTRUMENTS
THRUSTORQ FORCE MEASURING DEVICES
BOILER COMBUSTION CONTROL SYSTEMS
METALLURGICAL FURNACE CONTROL SYSTEMS

Hagan Corporation
Hagan Building
Pittsburgh 30, Pennsylvania

Please send me further information on Hagan Ring Balance Meters. I am particularly interested in

NAME _____

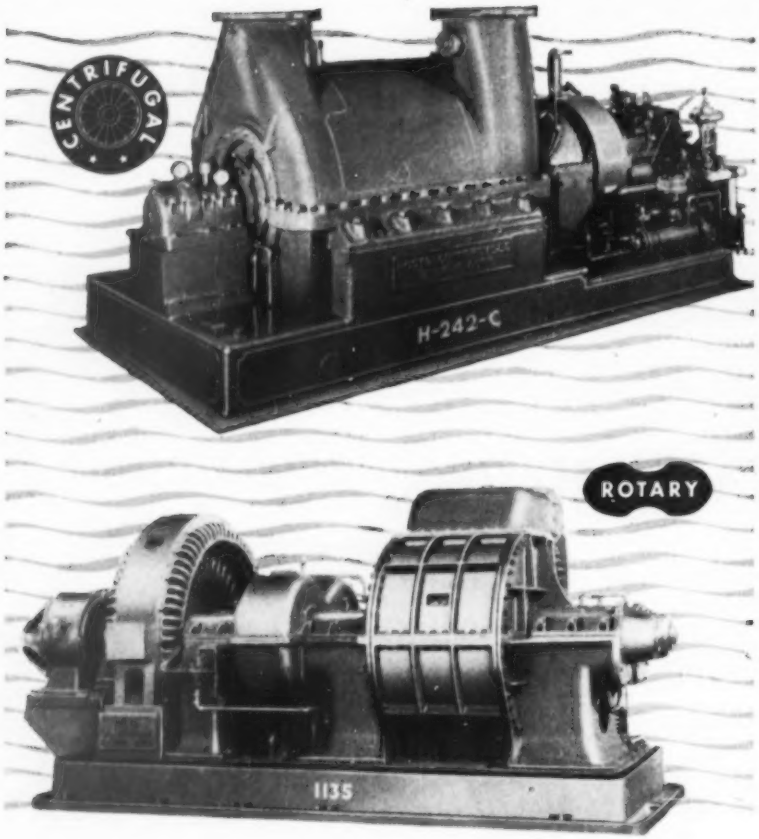
POSITION _____

COMPANY _____

STREET AND NUMBER _____

CITY _____ ZONE _____ STATE _____

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.



BLOWER RELIABILITY A "NATURAL" WITH AIR-MINDED *Specialists*

The long record of reliability established by Roots-Connersville Blowers, Exhausters and related equipment is the natural result of almost a century of experience in the exclusive business of handling gas and air for industrial purposes.

But its more than just designing and building *a* piece of machinery. Such user satisfaction comes also from the wide range of capacities and types, from which the right unit can usually be selected. Especially important, our *dual-ability line* of Centrifugals and Rotary Positives enables us to make unbiased recommendations . . . a *dual choice* available only from Roots-Connersville.

Whatever your need may be in the handling of air or gas for sewage or water treatment plants, you can look to Roots-Connersville for unquestioned reliability and long-time economical performance. Ask us for specific recommendations on any problem of handling gas or air—in any quantity.

ROOTS-CONNERSVILLE

Exclusive Specialists in Handling Gas and Air

BLOWER BUILDERS SINCE 1854

ROOTS-CONNERSVILLE BLOWER

A Division of Dresser Industries, Inc.
235 Mount Ave. • Connersville, Indiana

(*Continued from page* 102A)

Both men have been associated with the pump manufacturing industry for many years at Johnston and other firms.

Plastic Well Screen

1207

Southwest Well Screen Company, Jonesboro, Louisiana, has developed a new well screen of extruded Tenite butyrate plastic that permits production of satisfactory water supplies in many places where corrosion or incrustation makes the use of metal screens impractical.

The screen consists of a length of perforated black Tenite pipe, machine-wrapped with wire-like stripping of translucent yellow Tenite. The butyrate plastic is extremely tough, won't shatter or corrode, and is resistant to most oils and greases. It has good dimensional stability under normal ranges of heat and humidity.

Easy to install, the screen is made in lightweight 5-foot sections which may be connected together to attain any length desired. Diameters up to 4 inches are available. According to the manufacturer, the Tenite screen is ideal for wells up to 200 feet in depth.

Art Concrete Works Changes Name

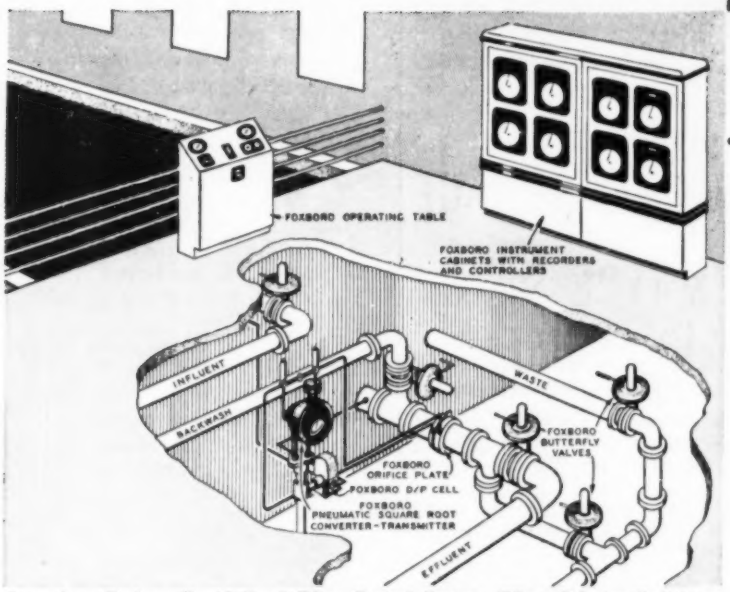
Art Concrete Works, Pasadena, California, has announced that the company name has been changed to Brooks Products, Inc.

According to Mr. Frank M. Brooks, President, the reason for the change was that: "Since the greatest part of our present company activity is concerned with the manufacture of concrete meter and valve boxes for

(*Continued on page* 106A)

New! Exclusive!

"Fingertip" Control for rapid sand filters...



A modern Foxboro Rapid Sand Filter Control System. When Selector Switch on operating table is turned to desired position Foxboro Controllers automatically take over operational control of valves.

...a "foolproof" system that is easier to install, to operate, and to maintain

The New Foxboro Rapid Sand Filter Control System combines maximum operating convenience with a minimum of maintenance. Its all-pneumatic transmission and control eliminates drums, cables, and pulleys . . . makes possible remote operation of valves without high pressure piping to the control panel.

In normal operation, the operator needs only to turn the selector switch to one of its four positions to control: filtering; influent-off; backwashing; effluent-to-waste. Also, all adjustments of filtering and backwashing rates are easily made at the operating table.

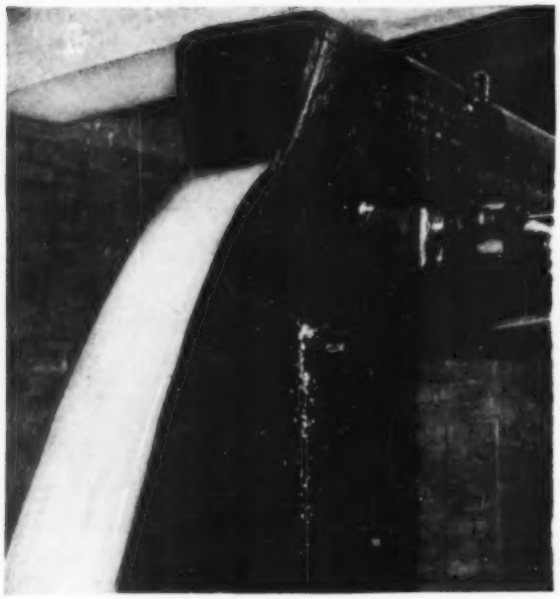
All connections are made with ¼" copper tubing. Hence, installations with remote setting of flow rates . . . and with supplementary remote indication . . . are simple and economical.

Write for detailed Bulletin 466. **The Foxboro Company, 8912 Neponset Ave., Foxboro, Mass., U.S.A.** Branch offices in principal cities.

FOXBORO REG. U. S. PAT. OFF. **CONTROL SYSTEMS**

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.



For Accurate Measurement of

RAW WATER, TRADE WASTES, SEWAGE

Specify SIMPLEX TYPE S PARABOLIC FLUME

Intelligent planning of industrial waste or sewage treatment facilities requires accurate flow data. Accurate control of processes and dosages are wholly dependent on accurate flow measurements.

Quite often, conventional types of primary devices can't answer this basic question because of adverse conditions such as: low flows under low head conditions; very wide flow ranges; heavy sediment or suspended solids; size, layout or grade of existing approach section; corrosive liquors in channels or pipes.

Simplex Type S Parabolic Flume was designed specifically to master *all* of these problems . . . accurately measures free-flowing wastes or sewage over a FULL 20 to 1 flow range!

Compact Type S Parabolic Flume is simple to install . . . requires a minimum of supporting structure, as shown in the above installation. Carefully machined levelling pins assure the correct grade for accuracy. No special approach section is needed.

Available in standard pipe sizes of 6" to 36", with bell, spigot or flanged inlet, Type S Parabolic Flume can be attached to even larger pipe sizes by means of eccentric reducers.

INTERESTING FREE BULLETIN

Why not get full details today. Write for Bulletin 800. Simplex Valve & Meter Company, 6743 Upland Street, Philadelphia 42, Pa.

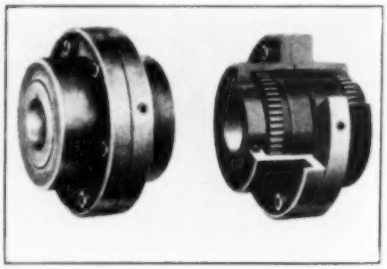
IT'S SIMPLEX IT'S ACCURATE

SIMPLEX®

VALVE AND METER COMPANY

(*Continued from page* 104A)

water and gas installations, and not of ornamental concrete products the name "Art Concrete Works" was misleading and inappropriate, therefore we have changed the name to Brooks Products, Inc."



New Geared Flexible Couplings

1208

Link-Belt Company, Chicago, Ill., has announced a new line of geared flexible couplings for high speed and high torque applications. These couplings combine sturdiness and light weight. Besides transmitting power efficiently, they accommodate a reasonable amount of shaft misalignment and end float.

Ten standard sizes are available, with bores ranging from one inch to six inches and with horsepower rating at 100 r.p.m. ranging from 2 to 450. Hubs bored for either slip or shrink fit on shaft can be furnished.

The two-section, free-floating housing has internally cut gear teeth. The two sections are rabbet fitted and are bolted together to function as a single rigid unit, forming a dust-proof, lubricant-retaining enclosure.

The wide face of the internal gear teeth provides for end float of connecting shafts while maintaining full tooth contact. The externally cut gear teeth of the hubs are machined to provide constant clearance at the root of the internal teeth of the housing, thus accommodating reasonable misalignment.

Worthington-Gamon Appoints 3 Western Representatives

Worthington-Gamon Meter Division of Worthington Corporation has announced three new appointments to the division's sales force.

Sidney S. Small has been appointed sales representative for Worthington-Gamon's Los Angeles District. Mr. Small had previously been with Worthington-Gamon from 1934 until 1945, when he resigned to act as a manufacturers representative. Prior

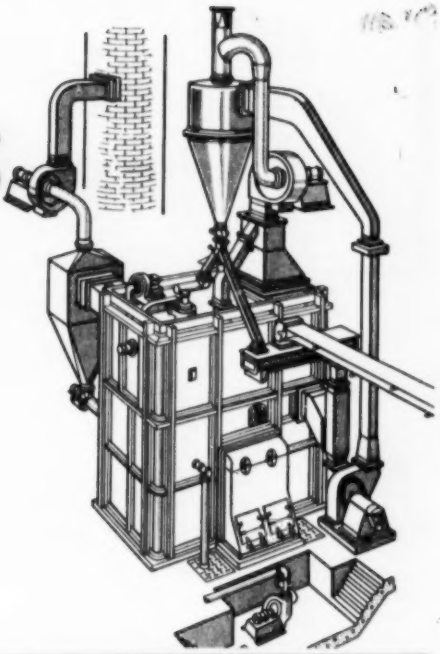
(*Continued on page* 108A)

10,000 Tons of Filter Cake per Day

...the capacity of

C-E RAYMOND SYSTEMS

of Flash Drying and Incineration



The most widely used heat method of sewage sludge disposal is the C-E Raymond System of Flash Drying and Incineration. Total daily capacity of C-E Raymond Systems installed, under construction or on order is more than 10,000 tons of filter cake, based on 24-hour operation . . .

This is nearly 50% more than the total of all other heat methods.

One important reason for this marked preference for the C-E Raymond System is that it is the most widely proven method that permits the flash drying of sludge to a saleable fertilizer or its incineration to a sterile ash . . . in either case with the deodorization of stack gases if desired. No other method offers this practical flexibility.

Another reason is that the C-E Raymond System has been service-proved in actual use in communities of every size—ranging in equivalent populations from 6,000 to 3,600,000 . . . and located in all parts of the country from coast to coast.

Like the communities listed at the right, you, too, can plan to end your sludge disposal problems by the proven C-E Raymond System. For full information, just get in touch with the C-E Raymond office nearest you. A C-E specialist will be glad to help you.

B-695

C-E Raymond Systems installed, under construction or on order since 1945

Installation	Consulting Engineer
Baltimore, Md.	Whitman, Requardt & Associates
Bethlehem, Pa.	Morris Knowles
Bloomsburg, Pa.	Gannet, Fleming, Corddry & Carpenter
Camden, N. J.	Havens & Emerson
Chicago, Ill. (W. So.W.)	City Engineering Dept.
Edgewater, N. J.	McClave & McClave
Fond du Lac, Wis.	Jerry Donohue Engrg. Co.
Galveston, Texas	Joe J. Rady & Co.
Houston, Texas	Greeley and Hansen
Lansing, Mich.	Drury, McNamee and Porter
Los Angeles, Cal.	Metcalf and Eddy
Miami, Fla.	Metcalf and Eddy
San Diego, Cal.	Frank Currie
San Francisco, Cal.	Clyde C. Kennedy
Schenectady, N. Y.	Havens and Emerson
Sheboygan, Wis.	Jerry Donohue Engrg. Co.
Washington, D. C.	Greeley and Hansen
Waterbury, Conn.	Malcolm Pirnie
Wyomissing Valley, Pa.	Albright & Friel
York, Pa.	Albright & Friel

C-E

COMBUSTION ENGINEERING, INC.

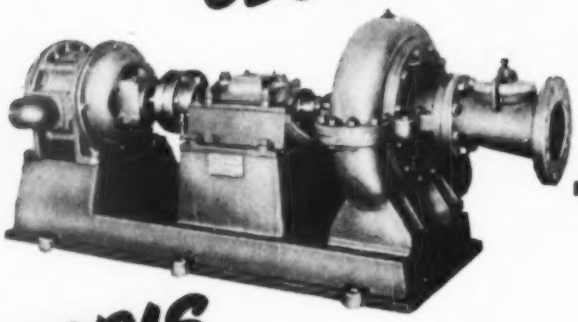
RAYMOND DIVISION

1315 North Branch Street, Chicago 22, Illinois

Western Office: 510 W. Sixth St., Los Angeles 14, Cal. • Eastern Office: 200 Madison Ave., N. Y. 16, N. Y.

ALSO FLASH DRYING AND INCINERATION SYSTEMS FOR INDUSTRIAL WASTE DISPOSAL

Even large solids pass WITHOUT CLOGGING!



MORRIS CENTRIFUGAL PUMPS

Specially designed to withstand tough operating conditions in any sewage plant.

Despite the severe operating conditions which occur in some sewage plants, the Morris Pumps continue to function dependably, efficiently and economically.

Morris Pumps will handle long, stringy, fibrous materials. Extensive experience in handling mixtures containing abrasive solids enables Morris to design for moderate quantities of grit, without undue impairment. Operation under abnormal conditions such as these prove unquestionably the rugged, superior construction of Morris Pumps.

Morris Pumps are Easily Installed... Easily Maintained...Easily Dismantled

Both the casing and the suction nozzle have hand holes . . . and the construction of the pump permits easy dismantling.

The castings are heavy. And the pumps are mechanically and hydraulically designed for greater resistance to abrasion.

Both the horizontal and vertical Morris Pumps are available in sizes ranging from 3" to 20" and adaptable to all types of drives.

Every pump is backed by 84 years' experience . . . carefully and practically tested for high sustained efficiency at low operating cost.

America's Largest Cities are Now Using Morris Centrifugal Pumps for More Dependable Service

Morris Machine Works, Baldwinsville, N. Y.
Offices in Principal Cities

MORRIS Centrifugal Pumps

(*Continued from page* 106A)

to 1934 he had been, successively, engineer for the Arthur Iron Mining Co., Hibbing, Minn., partner in an industrial engineering firm, and self employed as an industrial engineer.

William L. Tucker has also been retained as sales representative for the Los Angeles district. He has been with the Worthington-Gamon Los Angeles district office since 1951, serving in a production capacity. Mr. Tucker, a native of St. Paul, Minn., was associated with Minnesota Mining and Manufacturing Co. from 1941 to 1951. His last position was assistant traffic manager.

From 1942 until 1945 Tucker was with the U.S. Army Air Forces, serving in Europe part of the time.

Roy A. Saylors will represent Worthington-Gamon in the Denver and Salt Lake City districts. Mr. Saylors attended the University of Nabraska and has been associated with the City of Lincoln, Nebraska as Meter Superintendent for the Water Department. Mr. Saylors will make his home in Denver.

Skinner-Seal Valve and Bibb Reseater

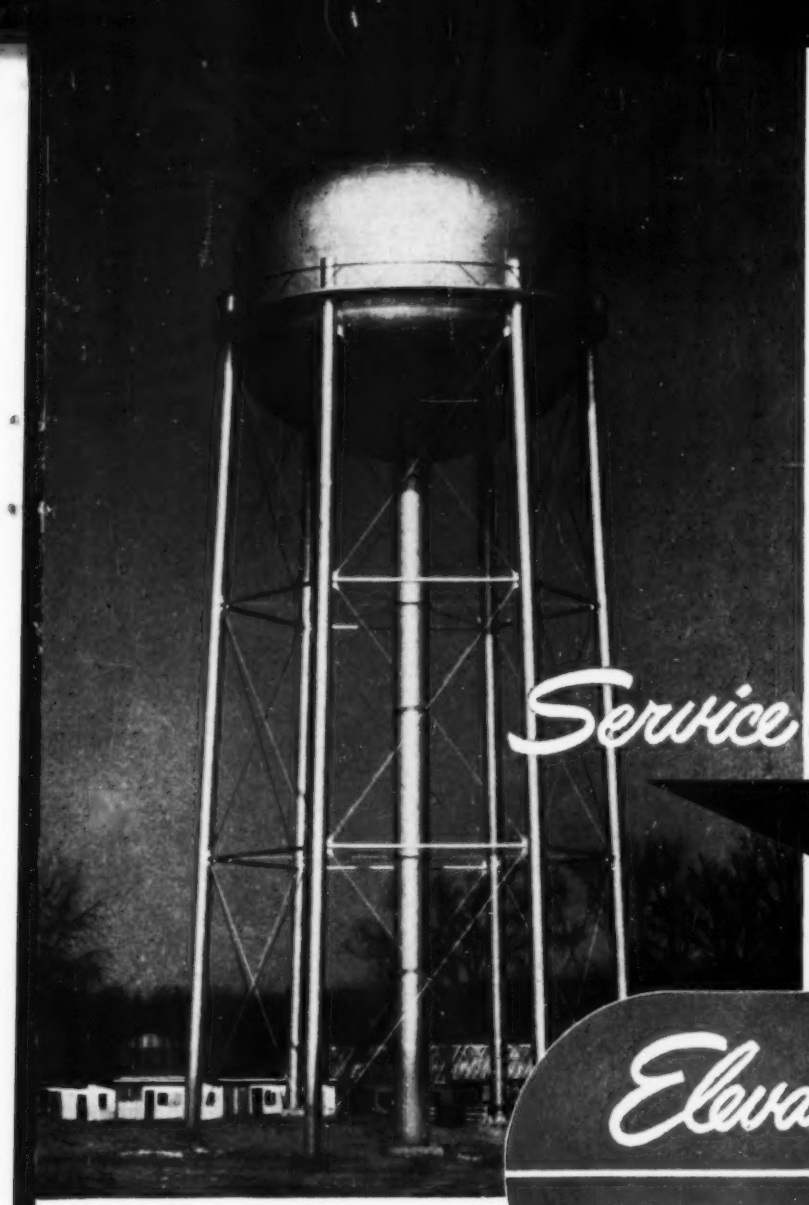
1209

M. B. Skinner Company, South Bend, Indiana, has announced that the Skinner-Seal Valve and Bibb Reseater is now available in a newly designed black and green, fitted Styrene case.

The new fitted case provides individual wells and grooves, with part numbers stamped in each, for every item in the kit. It is designed to house either the 2" size tool for ½"-2" valves and ¼"-¾" bibbs, or the 3" size for ½"-3" valves and ¾"-¾" bibbs. A 2" Skinner-Seal Valve and Bibb Reseater can be easily expanded to a 2½" to 3" size by ordering only those parts identified by the empty wells. This applies to ordering replacements, also.

Bar type cutters operating under screw feed, leave worn, scored seats glass smooth, level, absolutely tight.

(*Continued on page* 110A)



For EVANSVILLE, Indiana
State Hospital

Service and Protection

through dependable
water storage!

Elevated Steel Tanks

PITTSBURGH·DES MOINES

On guard night and day, this 400,000 gallon Pittsburgh-Des Moines steel elevated tank provides constant water supply at uniform pressures for Indiana State Hospital—plus ever-present fire protection, independent of other sources. The Double-Ellipsoidal tank is 48 ft in diameter, with head range of 34 ft 6 ins, on a 100 ft tubular column tower. *Write for our Water Storage Bulletin 101.*

PITTSBURGH • DES MOINES STEEL COMPANY

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25)	3418 Neville Island	DES MOINES (8)	919 Tuttle Street
NEWARK (2)	218 Industrial Office Bldg.	DALLAS (1)	1223 Praetorian Building
CHICAGO (3)	1222 First National Bank Building	SEATTLE	526 Lane Street
LOS ANGELES (48)	6399 Wilshire Blvd.	SANTA CLARA, CAL.	625 Alviso Road

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

Here's why SEWAGE TREATMENT PLANTS Modernize WITH HOMESTEAD Self-Seald...Lubricated PLUG VALVES

1 THEY'RE SELF-SEALING.

2 THEY AUTOMATICALLY ADJUST FOR WEAR.

3 HAVE 100% LUBRICANT SEAL AROUND PORTS.

4 USE LESS LUBRICANT.

5 THEY GIVE POSITIVE SHUT-OFF AND REMAIN DROP-TIGHT for extremely long periods of time.

HOMESTEAD "SELF-SEALD" LUBRICATED PLUG VALVES controlling raw, recirculated and digested sludge at 15 lbs. to 20 lbs. working pressure to heaters, digesters, and drying beds in a Sewage Treatment Plant.

Homestead's exclusive Self-Sealing feature combines the positive sealing action of the tapered plug with the free turning action of a cylindrical plug type valve. And because they are Self-Seald—*automatically adjust for wear as wear occurs*—they assure extra long, leakless service . . . more operations between lubrications . . . require less maintenance and materially lower plant operating costs.

More than 10 years of gruelling service in almost every type of industry has proved them to be the lowest-cost-per-year means of fluid control within their service range.

We make them in semi-steel or cast steel; 100% port area or Venturi type; sizes ⅛" to 14" for 200 lbs. oil-water-gas working pressures; in Straight-Way or Three-Way types for Wrench or Worm and Gear operation, with High or Low Head Extensions, and Hand Wheels or Floor Stands.

Self-Sealing or one-piece plugs optional in Straight-Way type; 3-Way type has one-piece plug only. Complete data and prices on request.

Write today for VALVE REFERENCE BOOK No. 39-5

How the Amazing "SELF-SEALD" Principle Works

Homestead's patented "Self-Seald" principle is, we believe, the simplest and most effective sealing principle yet developed for lubricated plug valves.

In addition to a full lubricant seal around the ports, and around the top and bottom of the valve, the wedge-action of the plug under line pressure causes the finely-finished surfaces of the plug to press outward against the sealing surfaces of the body.

This self-sealing action keeps the plug surfaces in contact with the bore of the body. The plug automatically adjusts itself for wear, thus assuring extra long life and maximum leakless service.

HOMESTEAD
VALVE MANUFACTURING COMPANY
"Serving Since 1892"

P. O. BOX 41 CORAOPOLIS, PA.

(*Continued from page* 108A)

Low spots on the seats, grooves, uneven places, have no effect. The cutter rotates on a level plane and is advanced by slight turns of the feed screw until the job is done.

F. Grilli Joins Diamond Alkali

Diamond Alkali Company, New York, N. Y., has announced that Frank Grilli, of Brooklyn, N. Y., has joined the New York branch sales office staff of the Company.

Active for many years with Innis, Speiden & Co., of New York, importers, exporters and manufacturers' agents of industrial chemicals, colors and allied products, Grilli was most recently manager of their resale chemical department. He will be located at Diamond's New York office, 122 E. 42nd Street.

New Printing Calculator

1210

Remington Rand, Inc., New York, N.Y., has developed a new Printing Calculator, Model 99, to handle specialized figurework requirements in the Public Utilities field such as percentage calculations for statistical reports, rate budget and load studies, computing unit prices for materials and stores, extending stores requisitions, allocating stores overheads, and distributing construction overheads and minor material to measure units of property. This compact, ten-key machine provides a quick solution and permanent tape record for any problem involving fully automatic multiplication, division, addition or subtraction.

Invoices and sales figures, payrolls and tax returns, inventories and statis-

(*Continued on page* 112A)

Niagara Falls selects ALOXITE® underdrains

Photo courtesy Bell Aircraft Corp., Niagara Falls, N. Y.

Within the past ten years Niagara Falls has grown tremendously. Industries have expanded. Population has soared. And, of course, water consumption has grown apace. It may seem a paradox, but the site of the world-famous falls recently was faced with an extremely tight water-supply situation.

When it became apparent that their filter capacity needed expanding, the City retained consultants to make a thorough investigation. They checked on modernizing the old plant but decided—in view of future needs—that the first step should be a new plant. Then came design and selection of the most up-to-date equipment available. In the case of filter bottoms, the field narrowed to three types. And, we are proud to say, ALOXITE aluminum oxide plates were selected.

Niagara Falls and their consultants are to be congratulated for their careful study of the filtration problem. It will bear fruit in the operation of their fine, new plant. The porous underdrain plates, as our contribution, will help materially in gaining high operating efficiency, and easy, low-cost maintenance.

Credit is due Mr. H. R. Cheek—City Manager: Mr. J. T. Fish—Director of Water Dept.; Greeley and Hansen—Engineers (Chicago, Ill.); and Roberts Filter Mfg. Co.—Contractors (Darby, Pa.)

CARBORUNDUM
Registered Trade Mark

FREE— Send for this useful 56-page booklet. It describes the different systems of filtration and diffusion—tells how to specify, order, install, operate and maintain. Address Dept. M-123, Refractories Div., The Carborundum Co., Perth Amboy, N. J.

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

CLARK SERVICE BOXES

Neat – Safe – Permanent

This cast-iron plug screws into brass insert . . . cannot be twisted or broken off.

Sliding adjustment prevents frost from disturbing base and curb cock.

Steel extension rod with welded joints—available with all types of boxes.

STYLE A—Clark Service Box for use with iron pipe.

STYLE B—for use with lead (illustrated) or copper pipe.

STYLE M—for use with Minneapolis Type Curb Stops.

write

H. W. CLARK CO.

MATTOON, ILLINOIS

(*Continued from page* 110A)

tical reports are but a few of the accounting jobs within the capabilities of this new machine. Today, where the widespread practice is to initial the tape and clip it to the worksheet, the Model 99 operator can do so even in multiplication and division.

Contributing to these peak results are a number of exclusive, newly-engineered features. Chief among them are Simpla-Tape, Automatic Clearance, Constant Multiplication, and Total Control.

McDonald Brothers Adds Design and Engineering Dept.

McDonald Brothers, Los Angeles, Calif. construction firm, has announced the addition of a design and engineering department which will be an integral part of their present construction service.

Russel D. Koons, formerly with the Bechtel organization for eleven years, will spearhead this addition with experience gained from more than sixteen years in engineering and construction of major projects, including water and sewage works, oil refineries, shipyards, industrial and chemical plants.

George S. Ballew, formerly with Stone & Webster Engineering Corp., is a well known specialist in petroleum process design. He will manage McDonald's service departments for the petroleum industry. Mr. Ballew has twenty-four years experience in all phases of petroleum engineering and construction.

Sveen-Pedersen Expands and Moves to Larger Quarters

Sveen-Pedersen Sales Corporation, New York, N.Y., has moved to larger quarters, in an expansion of facilities to meet an increasing need for their equipment.

The new location is at 25-36 Jackson Avenue, Long Island City, New York.

Elgin and Refinite Unite

Elgin Softener Corp., Elgin, Ill., has announced that Refinite Sales Company, Omaha, Nebraska, has joined forces with Elgin Softener Corporation, Elgin, Illinois. Both Elgin and Refinite are well known in the water conditioning field, Elgin having been established in 1908 and Refinite in 1916. The combined products of these old-established firms comprise a most complete line of water conditioning equipment and water treating chemicals and the join-

(*Continued on page* 114A)

Today it's Carlon!

Gone are the days of rugged installation work. CARLON Plastic Pipe can be installed faster, easier and without special rigging equipment. CARLON is lightweight, only 1/8th the weight of steel. CARLON is flexible . . . it bends to conform with irregular ditch lines. CARLON comes in long lengths . . . 400 feet can be run without a fitting. Yet connections can be made easily between CARLON lengths or to existing metallic lines.

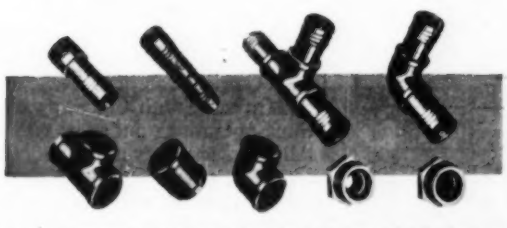
CARLON is immune to rot, rust and electrolytic action . . . corrosive soils and waters do not affect it. CARLON installations for drainage, sewage, drinking water, gas or electrical conduit require less maintenance . . . replacement is practically eliminated.

Install modern pipe for modern requirements. Specify CARLON Plastic Pipe. Every foot of CARLON is factory tested at greater-than-working pressures for more than 8 hours.

Buy the Pipe with the Stripe!

Write today for catalog

1452-CP



CARLON PRODUCTS CORPORATION

Pioneers in Plastic Pipe

CARLON plastic pipe is produced in Ohio, Colorado, North Carolina, Oregon, Texas and Ontario • Export: H. E. Botzow, New York City

10300 MEECH AVE. • CLEVELAND 5, OHIO

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

STEVENS

TYPE B-FT RECORDER PROVIDES PERMANENT DATA ON SEWAGE FLOW

At this modern sewage treatment plant in Dallas, Oregon, the STEVENS Type B-FT Recorder provides a permanent graphic record of flow in million gallons per day (range 0-6 MGD) and totalizes the volume in gallons. The STEVENS Recorder is mounted over a stilling well connected to a 9" throat width Parshall flume.

record flow accurately . . . automatically

There is good reason why modern municipal sewage and industrial waste measuring installations use the STEVENS Type B Recorder. It may be wall, pedestal or panel mounted, is easily operated and will give a lifetime of accurate, trouble-free service. This Recorder uses a circular chart which makes one revolution per day or per seven days, as specified, while the pen swings in an arc around an external center—the combined movements thereby producing a graph of the rate of flow (or head) against time. Volume is indicated on a counter-type totalizer. Accuracy of the registration is limited only by the accuracy of the rating to which the totalizer is set. Flow or head (or both) may be indicated on a scale clearly visible through a large glass port.

RECORDS FLOW
RECORDS HEAD
TOTALIZES FLOW
Direct Float Operated or Remotely Controlled

To find out more about the STEVENS Type B Recorder, and how it can simplify the task of compiling accurate flow records, write for FREE Bulletin 25.

SEND FOR NEW STEVENS DATA BOOK

Puts interpretive data at your finger tips. 144 pages of technical data . . . information on float wells and recorder installations . . . a wealth of hydraulic tables and conversion tables.

$1.00

Foremost in Precision Hydraulic Instruments Since 1907

LEUPOLD & STEVENS INSTRUMENTS, INC.

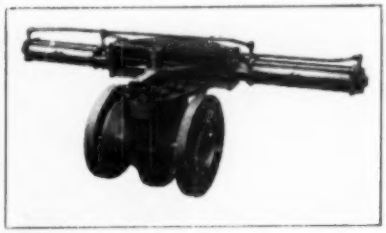
4445 N. E. GLISAN STREET • PORTLAND 13, OREGON

(Continued from page 112A)

ing of the research, technical, and sales organizations provides a far broader engineering service in principal cities throughout the United States, Canada, Mexico, and many other foreign countries.

The widely known industrial water conditioning products and services of both companies are now being handled by a combined sales-engineering organization known as Elgin-Refinite, Inc., a newly created division of Elgin Softener Corporation with headquarters at Elgin, Illinois.

The management states that the joining of organizations was suggested by analysis of the products and services of the two companies which revealed that each had much to offer to the other in equipment, research, men, and experience. In the case of overlapping products, the new developments and patented features of both Elgin and Refinite are pooled to the advantage of users.



Valve Actuators

1211

Ledeen Manufacturing Co., Los Angeles, Calif., has developed a new line of Valve Actuators that are designed as package units for installation directly on the valve in service, on valves at manufacturer's plant, or at distributor's warehouse.

These actuators are for the automatic operation of gate, plug, diaphragm, butterfly, pulp stock and other flow control valves, and are mounted directly on the valve without need of outside support.

Operated by air, gas, oil, water or steam, they feature power operation and direct or remote control.

S. Morgan Smith and R-S Products Merge

The S. Morgan Smith Company has announced the merger of its wholly owned subsidiary, R-S Products Corporation, Philadelphia. The S. Morgan Smith Company will continue operations under its own name. All sales, engineering and administrative functions have been moved to York, Pennsylvania, with sales and engineering being combined with the

(Continued on page 116A)

You'll have less infiltration . . .

reduce treatment costs . . .

conserve plant capacity . . .

Total infiltration in an all-Transite sewer system (over 5 miles of pipe) was so little the trickle had to be measured through a 3-in. pipe inserted in the Parshall flume!

—Because of this tight joint used with Transite® Sewer Pipe

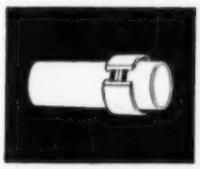
THE reduction of ground-water infiltration brought about by the Transite Joint—now standard on all sizes of Transite Sewer Pipe—can lead to a number of cost-saving results.

For example, on one recently installed Transite System using 28,540 feet of Transite Sewer Pipe, in diameters of 6 through 18 inches, the infiltration per inch of diameter, per hour, per mile of pipe came to a mere 0.85 gal. This low infiltration (including that from manholes and connections to house sewers) was achieved despite the fact that a considerable portion of this installation was below the prevailing ground water table. (For specification purposes, an infiltration allowance of 10 gallons per inch of diameter, per hour, per mile of pipe may be used with Transite Sewer Pipe.)

Obviously, such minimum ground-water infiltration helps reduce the load on treatment plants, cuts down on treatment costs, and conserves plant capacity for future expansion needs. This reduced infiltration plus Transite's high flow capacity (Manning's N=.010) often permits the use of smaller diameter pipe for new installations.

For further information on how this Transite Joint, used with corrosion resistant asbestos-cement Transite Pipe can help reduce your sewage costs, write Johns-Manville, Box 60, New York 16, N. Y. Ask for folder TR-103A.

Why this dependable joint cuts your sewage costs



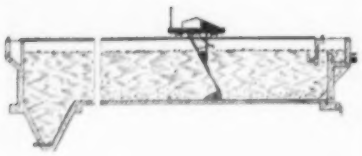
Two rubber rings and Transite Sleeve (cut away) can be assembled quickly over Transite Pipe ends to make an effectively tight joint. These flexible joints effectively absorb vibration, help compensate for soil movements.

TIGHT ALL THE WAY

Johns-Manville Transite Building Sewer Pipe assures a tight sewer system throughout. Many municipal officials are insisting that house and building connections to their sewage lines be made with Johns-Manville Building Sewer Pipe to assure tightness throughout their systems. This pipe also has the rubber ring sealed joint that is shown above.

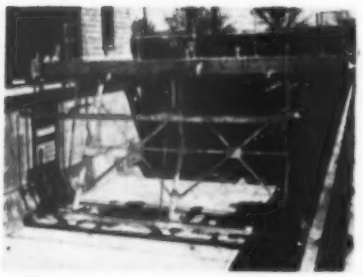
JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE SEWER PIPE



RECTANGULAR CLARIFIERS

FOR
SEWAGE
AND
TRADE
WASTES



Particularly suitable where space is limited or where sludge delivery is desired at one end of tank. Consists of a bridge crane spanning width of the tank supporting sludge scraper and skimmer, which moves automatically back and forth.

Many of these units are now operating in sewage plants throughout the country.

This unit has also proven highly successful as an oil-water separator in the treatment of oil refinery waste water. Bulletin 31-D-15

HARDINGE
COMPANY, INCORPORATED
YORK, PENNSYLVANIA · 240 Arch St. · Main Office and Works
New York · Toronto · Chicago · Hibbing · Houston · Salt Lake City · San Francisco

(*Continued from page* 114A)

present Valve Division. All correspondence should be addressed to the S. Morgan Smith Company, Lincoln & Hartley Streets, York, Pennsylvania. The telephone number is York 5425. The company will continue to manufacture the R-S line of valves at the Philadelphia plant.

Carl J. Wilcox will serve as Sales Manager for the newly consolidated Valve Division. Harry E. Shive will be Manager of Sales Service, directly responsible for the handling of inquiries and proposals. David W. Hopkins formerly responsible for the subsidiary valve division, will serve as Chief Valve Consultant and will function primarily in an advisory capacity. Russell C. Ayers, also of the R-S Products Corporation, has been appointed Assistant to the Sales Manager. Other key sales and engineering personnel of the subsidiary company will be located in York and will continue to service the R-S product lines.

Literature & Catalogs

Pipe Tools

1212

Beaver Pipe Tools, Inc., Warren, Ohio, has just produced a new envelope enclosure entitled **"3 New Products"** which features the new Beaver Model-D Aluminum Power Drive. This piece stresses the lightness and durability of the rugged unit. The folder explains its convenient portability and easy threading and cutting operations.

Printed in green and black, the enclosure also discusses the Beaver Model-C Power Drive and "77" ½" to 2" Power Drive Threader, as well as the 102-PD Power Drive Pipe Cutter. Photographs of the Beaver No. 55 Nipple Chuck, Chip Strainers, Reamers and Pipe Supports are also shown.

Cutless Rubber Bearings

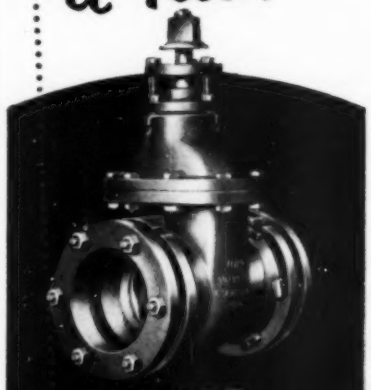
1213

Lucien Q. Moffitt, Inc., Akron, Ohio, has just published a new catalog which describes the use and advantages of **B. F. Goodrich Cutless Rubber Bearings** in industrial equipment.

The catalog contains engineering data of interest to plant engineers, product and equipment designers and recommends the use of Cutless rubber bearings in various types of industrial equipment such as pumps,

(*Continued on page* 118A)

Sure it fits!



IOWA
mechanical joint
gate valves

fit any class of cast-iron pipe
... save time and money

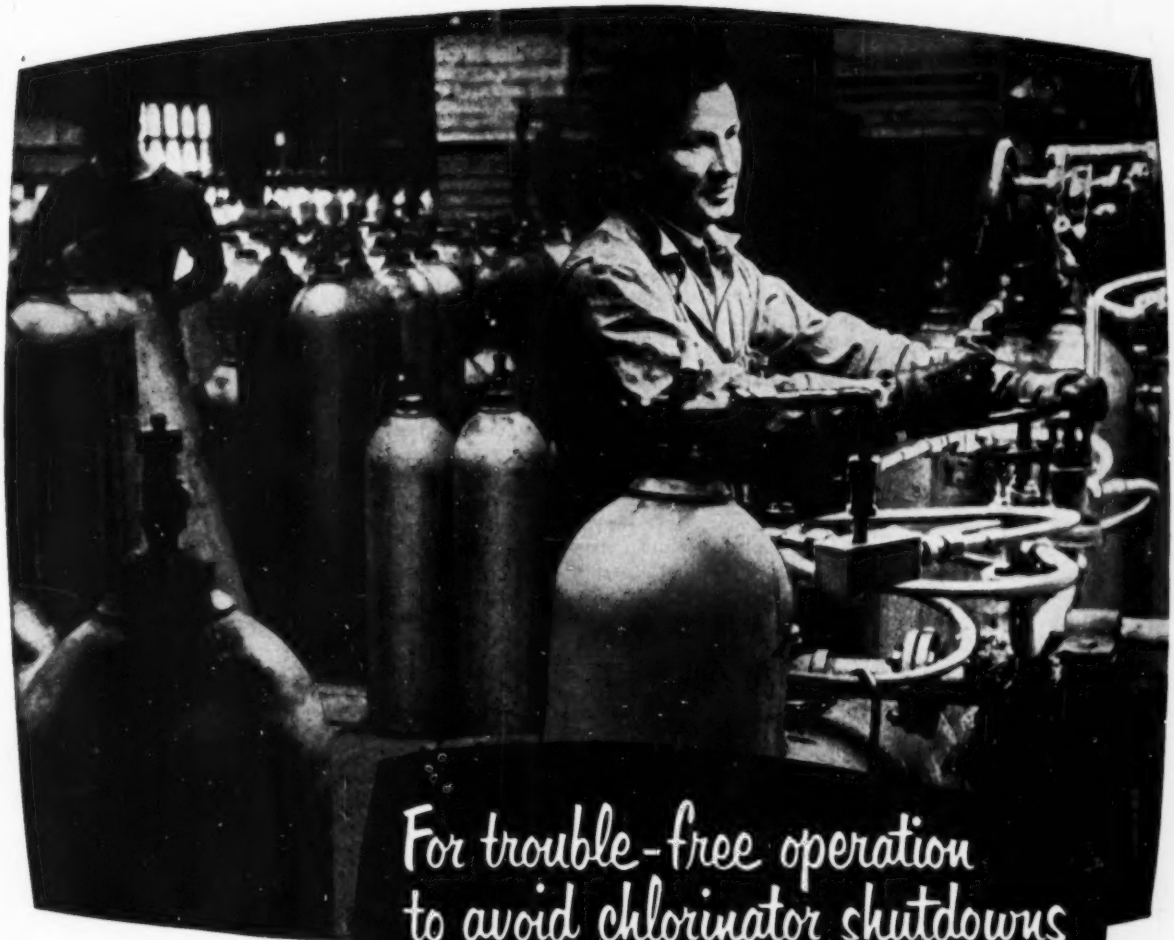
FOR EXPANSION or replacement. Because Iowa mechanical gate valves will fit the cast-iron pipe in your town's water works system, no matter how old. Modernizing or expanding your system is now easy, fast and low in cost!

SAVE MAN-HOURS. Just two workers with a ratchet wrench can install the Iowa valve in minutes. And because mechanical joints eliminate lead, jute or calking, work can be done even in a wet trench or in bad weather—no delays.

TROUBLE-FREE long life. Every joint makes up bottle-tight. Ruggedly built—fully bronze mounted. Parallel seat, double disc type with independent solid bronze wedges and stem nut.

MEETS A. W. W. A. specifications. Available in a wide range of sizes.

IOWA
VALVE COMPANY
201-299 N. Talman Avenue • Chicago 80, Illinois
A subsidiary of James B. Clow & Sons



Cylinder valves are disassembled and completely overhauled at Pennsalt plants each time empty cylinders are returned for filling. Valves and cylinders are re-checked after cylinders are filled with *purified* Chlorine.

For trouble-free operation to avoid chlorinator shutdowns

USE PENNSALT CYLINDER CHLORINE

Here's why...

Purified Chlorine Pennsalt Chlorine is clean . . . contains no taffy to clog up chlorinators and cause costly repairs and downtime. Pennsalt is a dependable manufacturer specializing in the purification of Chlorine. Cylinders are filled only with water-works grade Chlorine.

Cylinder Valves In Excellent Working Order Valves open and close properly, easily, do not leak. Valves on Pennsalt Chlorine cylinders are disassembled, repacked, and thoroughly inspected *each* time empty cylinders are returned to a Pennsalt plant.

Pennsalt Is In The Cylinder Chlorine Business To Stay Cylinder Chlorine is an important part of our business. Our customers are satisfied and we intend to keep on satisfying them in the future. Shipments are prompt, and Pennsalt's trained technicians are available to assist you in any way. Avail yourself of this purified Chlorine and dependable service now. Contact the district office nearest you!

DISTRICT OFFICES AND TELEPHONES

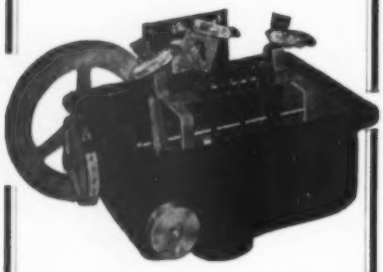
Appleton, Wis.—Appleton 3-9307
Berkeley 4, Calif.—Ashberry 3-2537
Chicago 1, Ill.—Andover 3-6170
Cincinnati 2, Ohio—Main 3168
Detroit 26, Mich.—Woodward 1-8051
Los Angeles 11, Calif.—Jefferson 6244
Paterson 1, N.J.—Lambert 5-3500
Philadelphia 7, Pa.—Locust 4-4700
Pittsburgh 19, Pa.—Atlantic 1-5233
Portland, Ore.—Atwater 7655
Tacoma 1, Wash.—Market 9101

Pennsalt Chemicals

PENNSYLVANIA SALT MANUFACTURING COMPANY, 440 WIDENER BLDG., PHILADELPHIA 7, PENNA.

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

ROTO-TROL



RF-2

WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles. The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

Write for full data

WATER LEVEL CONTROLS DIVISION

HEALY-RUFF COMPANY

783 HAMPDEN AVE., ST. PAUL 4, MINN.

(*Continued from page* 116A)

agitators and similar equipment where bearings can be lubricated with water or by the liquid handled in the equipment.

B. F. Goodrich Cutless, water lubricated rubber bearings have been used successfully as propeller shaft bearings on boats and vessels of all sizes and types for more than 25 years. The bearings, available in a complete range of sizes, are made of special rubber which resists wear and heat.

Anti-Rust Paints

1214

Paramount Industrial Products Co., Cleveland, Ohio, has just published a new 2-page catalog sheet describing **Apex Anti-Rust Paints.**

Illustrated with seven application photographs, the 2-color bulletin states that Apex Anti-Rust Paints stop rust in one application without surface preparation of any kind. The paints absorb surface rust and seal the clean metal beneath from further rust or corrosion, according to the leaflet. They can be applied by brush, spray, dip or roller.

Available in black, clear, aluminum, gray, red and green, Paramount paints are especially recommended for roller use in rust-proofing chain link fences.

Water Suction Hose

1215

B. F. Goodrich Company, Akron, Ohio, has just published a new catalog on **Water Suction Hose.**

The catalog describes four types of hose which cover all suction hose service. A table lists types of fittings and their recommended uses. The catalog also lists specifications, describes materials and methods used in construction of the hose and recommended uses.

Chart Shows Corrosion Resistance of Cements

1216

Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., has just prepared a **Resistance Chart** showing the resistance of seven classes of corrosion resistant cements to 297 of the most generally used corrosive chemicals.

The chart indicates that Pennsalt has a cement mortar which is resistant to the chemical attack of every one of these chemicals except sodium hypochlorite.

The type of cement mortars listed in the chart are: Silicate—Penchlor;

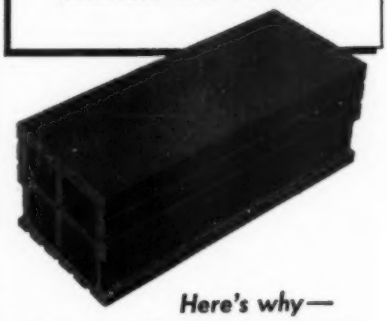
(*Continued on page* 120A)

IT PAYS TO Specify

LEOPOLD

Glazed Tile

FILTER BOTTOMS



Here's why—

Permanent • No corrosion or tuberculation • Equal distribution • Low loss of head • Requires only small sized gravel • No metal in contact with water!

Write today for details

F. B. Leopold Co., Inc.

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Pittsburgh 4, Pa.

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The Pioneer Self Caulking Material for C. I. Pipe

Thousands of miles are—

Jointed with LEADITE for Satisfaction and Long Life

because Leadite makes a good, tight joint that improves with age . . . and in addition, saves on installation costs.

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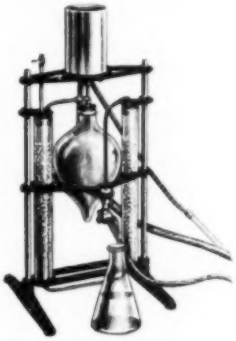
THE LEADITE COMPANY

Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking

ENSLOW

Stability Indicator



For checking the equilibrium of a finished water, and supplying an index useful in controlling anti-corrosion treatment. Catalog No. 83-895

WRITE:

Phipps & Bird, Inc.

P. O. Box 2V Richmond 5, Va.

STEEL PIPE chosen for U. S. Government's new $4,500,000 walk-through piping tunnel

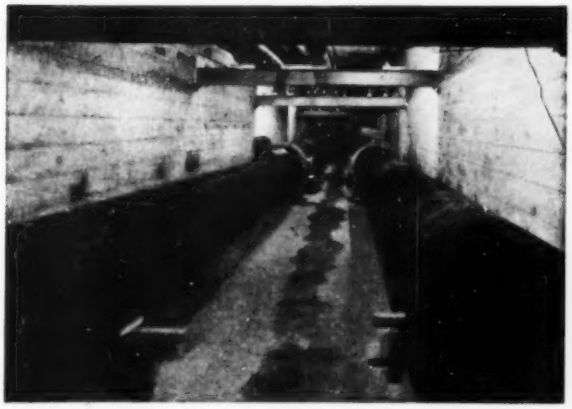
Upon completion of a $4,500,000 walk-through piping tunnel now under construction at the nation's capital, four major government buildings will receive and return cooling water for their air-conditioning systems through a vast network of Alco Electric Welded Steel Pipe.

Main lines in the network will be 30-in. in diameter and will total about 9,280 ft in length. Branch lines will range from 8 to 20-in. in diameter and total about 1,200 ft.

Electric Welded Steel Pipe, is selected for water-supply installations all across the country on the basis of 4 simple, sound, dollars-and-sense reasons: *One*, it's strong and resilient—vibration, impact and overloading that shatter other types of pipe leave Electric Welded Steel Pipe unaffected. *Two*, it's efficient—it's positively watertight, and the smooth tar-enameled surface gives maximum rate of flow. *Three*, it's economical—first cost is low; and delivered in long, light sections, it takes minimum time and labor to install. *Four*, it's durable—conservative estimates put its life at 75 to 100 years.

Alco Electric Welded Steel Pipe can be fabricated to meet almost any specifications. Sizes run to whatever practical lengths the available transportation will carry. Pipe 30-in. in diameter and over is made in lengths up to 40 ft without girth seams. Pipe under 30-in. in diameter is made in 22 ft lengths without girth seams (or longer lengths with girth seams).

Whatever the nature of your own installation—be it large or small, special or standard—give Alco Electric Welded Steel Pipe your careful consideration. For complete technical data—and for expert help with your own special problems—contact your nearest Alco Products sales representative.



30-IN. CHILLED WATER LINES of long-lasting Alco Electric Welded Steel Pipe in new walk-through tunnel now under construction at Washington, D. C., will total approximately 9,280 ft.

WITH GIANT BENDING ROLLS and other modern production facilities Alco fabricates large-diameter Welded Steel Pipe to meet all requirements of water supply installations.

Remember these Key features of Alco Steel Pipe

STRONG: Unaffected by vibration. Maximum resistance to shock, and to overloading due to earth movement and washouts.

EFFICIENT: Positively watertight. Minimum number of field joints. Smooth coal-tar enameled interior surface for highest rate of flow.

ECONOMICAL: Low first cost. Long lengths, light weight, for easy installation.

DURABLE: Life in water-supply installations estimated conservatively at 75 to 100 years.

ALCO

ALCO PRODUCTS DIVISION
AMERICAN LOCOMOTIVE COMPANY
DUNKIRK, N. Y.

Sales Offices: New York, Chicago, Dunkirk, Los Angeles Kansas City, Houston, Tulsa and Beaumont.

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

Looking for lower costs in clarifying water?
Let N-Sol® Activated Silica Sol* be your answer to reduced chemical costs and higher quality water. In one mill, river water at high turbidity needs only one-tenth the amount of alum and half the number of shifts since using N-Sol.
Request free samples of N® Silicate and directions for making jar tests on your own water supply.
*N-Sol is prepared conveniently in your plant with N Sodium Silicate and a reactant chemical. No charge for license under our N-Sol Process Patents.
Philadelphia Quartz Company
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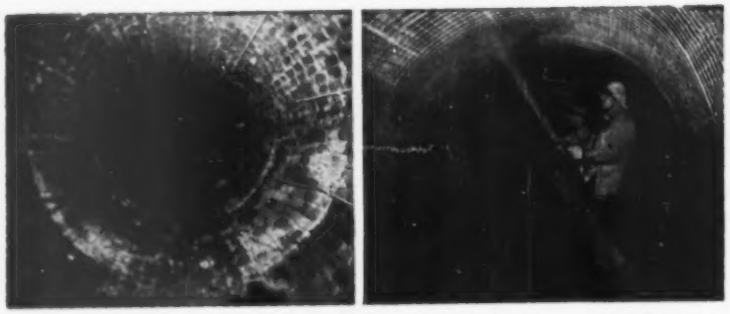
N-Sol® Processes
PQ® SOLUBLE SILICATES



"GUNITE" STRENGTHENS EXISTING SEWERS

Reinforced "GUNITE" lining has been successfully used on brick, tile and concrete sewers, restoring them to greater than originally designed strength.

Erosion of mortar joints and dislodged bricks made many sections of the above 65-year-old brick sewer in Illinois both dangerous and inefficient. We placed a reinforced "GUNITE" lining of varying thickness in this sewer without opening the streets.

Sewer service was maintained by installing temporary flumes and also by by-passing through relief sewers.

This job, and many other types of "GUNITE" jobs which we have done, are illustrated and described in our new 64-page general bulletin C2400. A request on your letterhead will bring you a free copy by return mail.

We will be pleased to cooperate with you on any of your problems.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES – ALLENTOWN, PA., U. S. A.
MANUFACTURERS OF THE CEMENT GUN

(*Continued from page* 118A)

resin type—Pennsalt Furan, Pennsalt Asplit, Pennsalt HF and Pennsalt PRF; and Sulfur—Pennsalt Sulfur and Pennsalt Carbon Sulfur.

The Pennsalt corrosion engineers pointed out that the new chart is intended only as a ready guide for engineers, construction and maintenance men, and purchasing agents in selecting chemical resistant cements to meet their particular problems.

Variable Speed Motors

1217

U. S. Electric Motors, Inc., has just released a completely revised and amplified Bulletin, lithographed in multi-colors, that discusses **Variable RPM's.** The bulletin outlines several scores of reasons why variable speed motors can be used to improve production and includes illustrations of all types of Varidrive motors. It includes 80 colored illustrations of motors, mechanical features, remote controls, etc.

Pittchlor Brochure

1218

The Columbia-Southern Chemical Corp., subsidiary of Pittsburgh Plate Co., Pittsburgh, Pa., has just published a new 24-page, two color illustrated brochure outlining the uses of **Pittchlor** for water, sewage treatment, and general sanitation purposes.

The publication outlines the advantages that Pittchlor offers to municipalities and also carries tables of solution strengths for a wide range of applications.

Gear-Motors

1219

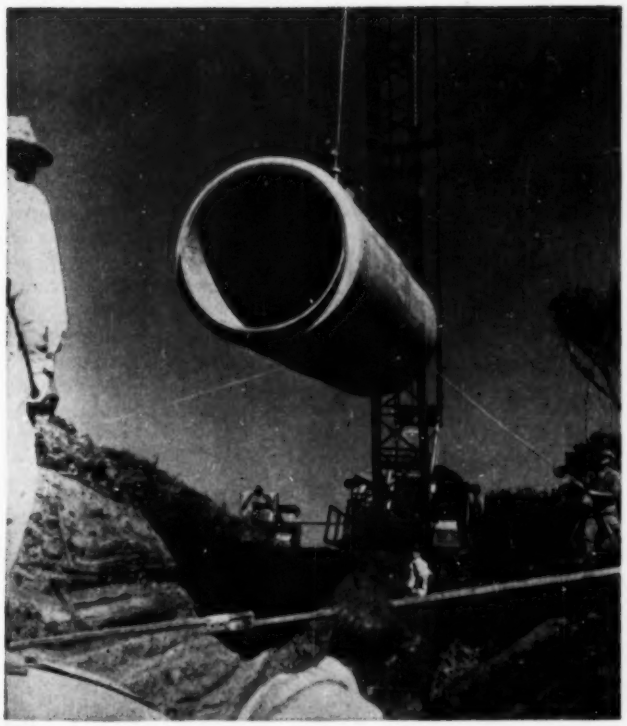
General Electric, Schenectady, N. Y., has published a bulletin that describes the function, design, and application of **Gear-Motors.**

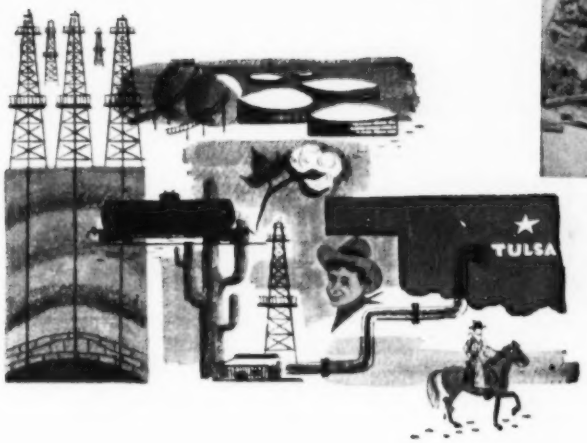
The sixteen-page, two-color information guide describes the standard types of G.E. Tri-Clad gear-motors with ratings from 1/6 up to 200 hp. Cut-away photographs show the relative position of the parts which are distinctive to the design of each motor.

Adaptability to low-speed jobs and adjustable-speed drives are explained, along with a description of gear-motor maintenance. The electrical types and characteristics as well as special mechanical features of gear-motors also are given. A table listing more than 200 gear-

(*Continued on page* 122A)

Tulsa Prefers Concrete Pressure Pipe





In 1923 when Tulsa reached out to Spavinaw Creek for pure, spring-fed water it selected concrete pressure pipe for the flow line. Fifty-two miles of 54- and 60-inch concrete pressure pipe were installed to carry a maximum of 25 mgd.

Twenty-eight years later Tulsa's phenomenal growth necessitated increasing its water supply, and the city again chose concrete pressure pipe. The new line, completed last year, using 66- and 72-inch pipe, parallels the original installation boosting Tulsa's total pipeline capacity to 63 mgd.

The confidence Tulsa engineers have in concrete pressure pipe is evidenced by the fact that it was selected a second time for the city's water supply system. The original installation had proven that concrete pressure pipe is efficient, economical, and lasting.

If your city is planning additional water lines, or replacements for old lines, be sure to investigate the distinct advantages of concrete pressure pipe.

Water for Generations to come

Concrete PRESSURE Pipe

AMERICAN CONCRETE PRESSURE PIPE ASSOCIATION
228 North LaSalle Street
Chicago 1, Illinois

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

M-SCOPE Pipe Finder

LIGHTWEIGHT MODEL

One Man Operation

HIGHLY EFFICIENT

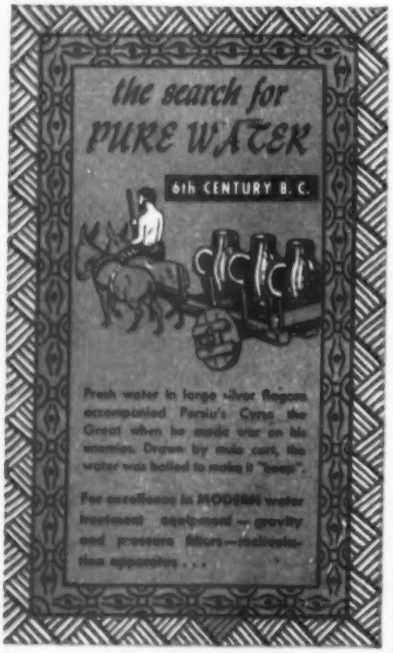
IMMEDIATE SHIPMENT

Catalog No. 25G On Request

JOSEPH G. POLLARD CO., INC.

Pipe Line Equipment

New Hyde Park **New York**



MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER MFG. CO.

607 Columbia Ave.

Darby, Pa.

(*Continued from page* 120A)

motor applications explains how to select the proper motor depending on use, load classification, and length of daily operation.

Zeolite Water Softeners

1220

Graver Water Conditioning Co., has prepared a bulletin on **Graver Zeolite Water Softeners.**

The bulletin explains the distinction between the sodium cycle and the hydrogen cycle of zeolite softening and graphically shows the difference in results obtained by the two processes. This fundamental discussion is followed by a description of the design and operation of equipment used in zeolite water softening and the available methods for controlling the various operations in the softening and regenerating processes.

An additional section describes the various types of the most modern zeolite or ion exchange materials, illustrated with photographs of actual size and also photomicrographs of typical exchangers, and with a table of the characteristics of the modern cation exchangers most commonly used in Graver Zeolite Softeners.

A final section of particular usefulness is an outline of a simple method of sizing zeolite softeners, with a table of recommended flow rates and an example showing how the size of a softener would be determined to meet specific requirements.

Industrial Controls

1221

Minneapolis-Honeywell Regulator Company, Philadelphia, Pa., has published a catalog on **Industrial Controls,** electric, electronic, pneumatic.

This well-illustrated 82-page catalog describes and gives specifications on non-indicating electric, electronic and pneumatic controllers for temperature, pressure and humidity, also pneumatic and electric valves, switches and relays.

Dimensional drawings, application data and ordering information are also included.

Tablet Hypochlorinator

1222

Reid Supply Company, Wichita, Kansas, has available a booklet on the **Beatie Tablet Hypochlorinator.**

This 10-page booklet discusses: Where to use the tablet hypochlorinator; What is hypochlorination; General information on chlorination;

(*Continued on page* 125A)

INCREASE SEWAGE PLANT CAPACITY WITHOUT CAPITAL COST!

WHAT IS IT?

- BIONETIC is a dry powder of preserved beneficial groups of micro-organisms that accelerate natural biological action.

WHAT DOES IT DO?

- BIONETIC can save money on sewage plant problems including odor control, increased sludge digestion capacity, and scum blanket control.

INTERNATIONAL ACCEPTANCE:

- BIONETIC is successfully used by hundreds of municipalities, industries, resorts, and institutions.

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P. O. BOX 6724 HOUSTON 5, TEXAS

CAST IRON PIPE

AND FITTINGS

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McWANE Cast Iron Pipe Company, Birmingham, Ala.

Pipe sizes 2" thru 12"

PACIFIC STATES Cast Iron Pipe Co., Provo, Utah

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Sales Offices Principal Cities

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SODIUM FLUOSILICATE

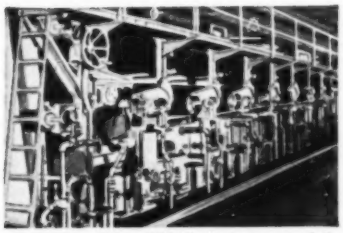
(Silico Fluoride)

Inquiries Invited

TENNESSEE CORPORATION

1028 Connecticut Ave., Wash. 6, D.C.

CELITE FILTRATION removes harmful impurities and purifies water for re-use



In paper plants "White" water used in paper formation is purified for re-use by Celite Filtration. The Celite method can also provide clean pure process water in many other industrial uses—for boiler make-up, heat exchangers, circulating water for towers, etc.

In oil wells—output is boosted by re-pressurizing wells with water to force out accumulated oil. Celite Filtration purifies water to the extreme degree required—removes the minute suspended impurities which would otherwise clog the microscopic pores of sandstone.

CELITE* FILTRATION can reduce your process water costs materially—and it can greatly aid your community's water conservation and anti-pollution programs.

If your plant now discharges industrial water as waste, Celite Filtration enables you to purify this water for *re-use*—at relatively low cost. Celite removes all types of suspended solids. When required, it even filters out fine matter such as amoebae and algae, many of which cannot be removed by other methods. Thus by recycling process water you can save on water costs . . . and save your community's water.

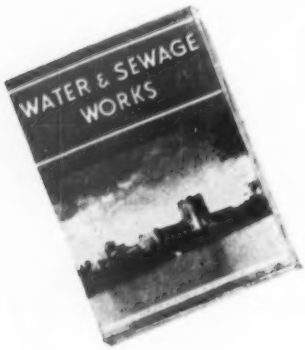
At such times as you still find it necessary to discharge process water, Celite Filtration is an important anti-polution measure. It helps make water safe and harmless . . . thereby protecting your community's recreational areas, fish and wildlife.

Food processors, beverage manufacturers, swimming pool operators and many industrial users of process water depend on Celite Filtration.

It will pay you to investigate the unique advantages of Celite for your particular application. Celite itself is carefully processed from the purest deposits of diatomaceous earth. It comes in nine standard grades, and you are always assured of utmost uniformity of product. To have a Celite engineer study your problem and offer recommendations, simply write Johns-Manville, Box 60, New York 16, New York. In Canada, 199 Bay Street, Toronto 1, Ontario. *T.M. Reg. U.S. Pat. Off.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville CELITE FILTER AIDS



"Every individual connected with water purification or sewage works should subscribe to this publication. I have introduced it to a host of friends in this field"

Testimonials such as this from subscribers to WATER & SEWAGE WORKS really tell the story. The man who reads and uses the magazine as an aid in his work knows how much it will benefit other workers in the field.

The great REFERENCE & DATA issue alone is worth more than the yearly subscription rate. In it you will find formulae, charts and illustrations covering information not obtainable in any other one source.

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(Add $1.00 per year for foreign postage)

- *If you are interested in the water field only you get all the authoritative data on this subject.*
- *If you are interested in sewage problems only you are kept fully informed and given much help in this field.*
- *If you are interested in both subjects you get all the information in this one monthly magazine.*

(*Continued from page* 122A)

Testing for chlorine; Source of chlorine—Calcium Hypochlorite tablets; Installing, Operation, and cleaning of the hypochlorinator.

Four pages are devoted to explanatory diagrams showing operating parts and installation hook-ups.

Rubber Lining Tanks Valves, Fittings

1223

Protective Coatings Division of Metalweld, Inc., Philadelphia, Pa., has just published an illustrated, two-color, 8-page bulletin describing the advantages and application of **Rubber Lining** to steel tanks, drums, pipes, valves, fittings and pumps.

Included in the bulletin are important tables giving the resistance characteristics of MW rubber lining to inorganic acids, salts and alkalies, organic materials and a wide group of miscellaneous materials. Details on the chemical, abrasive and temperature resistant qualities of rubber linings and the different types of linings available are also given. Metalweld's plant facilities for cementing, lining, and vulcanizing all types and sizes of equipment are illustrated, and the B. F. Goodrich Vulcalock Bonding Process, which joins rubber and steel together with a bond strength of over 500 psi, is described.

Close-Coupled Centrifugal Pumps

1224

Gardner-Denver Company, Quincy, Ill., has released a bulletin on **Centrifugal Pumps, Close-Coupled.**

The bulletin discusses pump types HB, HC, HD, HE, and HF in sizes from 1 to 5 inches. Complete tables are given showing gallons per minute and total heads for both the closed and open impeller types. Line drawings of the pumps along with motor requirements are also included.

Flowrator Meters

1225

Fischer & Porter Co., Hatboro, Pa., has released a new catalog titled **"An Introduction to Flowrator Meters."** The catalog discusses Flowrator meters and presents objective comparisons between these popular variable-area types and the more common variable-head meters. How the variable-area meter works, its basic flow equation, as well as information, on calibration scales, metering range, permanent pressure

(*Continued on page* 127A)

HYDRO-TITE

DEPENDABLE JOINTING COMPOUND

Seals Bell and Spigot Water Mains

Economical—Effective

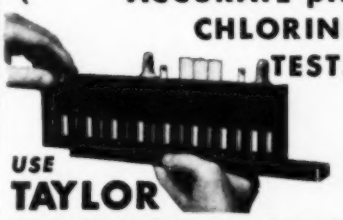
Over 35 Years Of Dependable Performance

HYDRAULIC DEVELOPMENT CORP.

MAIN SALES OFFICE **50 CHURCH ST., N. Y. C.**

General offices and works W. Medford Sta., Boston, Mass.

HOW TO MAKE ACCURATE pH, CHLORINE TESTS



***USE* TAYLOR COMPARATORS**

You can make determinations in a few seconds. Taylor Sets are lightweight, easy to carry for on-the-spot tests, or use in lab. Each set complete with reagents and accessories.

Easy as **A • B • C**

A. Fill three test tubes with sample to be tested and place them in the base.

B. Add reagent to middle tube only.

C. Place color slide on base, move across until colors match, and . . . THERE'S THE VALUE!

Guaranteed Color Standards!

Sealed-in-plastic color standards carry unconditional guarantee against fading. No single standards to handle. Each slide contains a complete set of standards for any one determination.

SEE YOUR DEALER for equipment. Write direct for FREE HANDBOOK on pH and chlorine control in 34 basic industries. Also illustrates and describes all Taylor Sets.

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WILKINSON LINE LOCATOR

The original—the pace setter

Built to QUALITY strict standards

Choice of discriminating buyers everywhere

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BELL JOINT LEAK CLAMPS

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Also Anchored Glands for mechanical joints to replace socket clamps.

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The difference between Life... and Death...

"Why should you give blood? Ask me—I ought to know. I fought in Korea. But since then I've been through the biggest battle of all—the battle for life itself. And it was blood—and blood alone—that saved me. Don't know when I'll be in a position to start repaying my debt by giving some blood of my own. But I will—some day. You can count on it!"

All kinds of people give blood—for all kinds of reasons. But every reason for giving blood is a *special* reason . . . just as every American life that can be saved at any time and at any place . . . is special. So whatever *your* reason for giving blood, this you can be sure of: Whether it goes to a combat area, a local hospital, or for Civil Defense needs—this priceless, painless gift will some day save an American life!

Give Blood Now

CALL YOUR RED CROSS TODAY!

NATIONAL BLOOD PROGRAM

Business Executives!

✓Check These Questions!

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ☐ Have you given your employees time off to make blood donations?
- ☐ Has your company given any recognition to donors?
- ☐ Do you have a Blood Donor Honor Roll in your company?
- ☐ Have you arranged to have a Bloodmobile make regular visits?
- ☐ Has your management endorsed the local Blood Donor Program?
- ☐ Have you informed employees of your company's plan of co-operation?
- ☐ Was this information given through Plant Bulletin or House Magazine?
- ☐ Have you conducted a Donor Pledge Campaign in your company?
- ☐ Have you set up a list of volunteers so that efficient plans can be made for scheduling donors?

Remember, as long as a *single* pint of blood may mean the difference between life and death for *any* American . . . the need for blood is *urgent!*

Large Diameter NEW STEEL PIPE

8⅝" O.D. .250 wall 1250 feet
8⅝" O.D. .352 wall 1080 feet
9⅝" O.D. .395 wall 800 feet
16" O.D. .250 wall 600 feet
24" O.D. .281 wall 4500 feet
24" O.D. .406 wall 1500 feet
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All 40 foot lengths

Small size pipe and tubing also available. Ideal for road crossings, culverts, conduit and irrigation.

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WANTED:

Sanitary engineer, preferably over 35, who has had responsible design of treatment plants, ½ m.g.d. to 15 m.g.d. Midwest location. Salary five figures.

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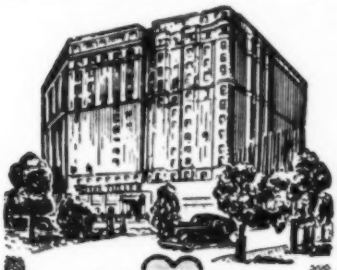

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VISIT OUR
COCKTAIL LOUNGE
ONE OF DETROIT'S FINEST

800 ROOMS from $3

Harry E. Poulsen, *Gen. Mgr.*

HOTEL TULLER

(*Continued from page* 125A)

loss, upstream piping effects, viscosity effects, purging, and pulsating flow, are all discussed.

Waste Engineering Brochure

1226

Gilbert Associates, Inc., Engineers, Consultants, and Constructors, Reading, Pa., has published a new brochure showing in words and pictures how GAI has incorporated the latest developments in waste engineering in the design of many sewage and industrial waste projects for municipalities, industries, and governmental agencies. A unique feature of the 34 page brochure is the back cover pocket which includes a smaller edition of the large book with project and client lists.

Water, Sewage & Wastes Treatment Equipment

1227

Ralph B. Carter Company, Hackensack, N.J., has available a bulletin on **Equipment for the Treatment of Water, Sewage and Industrial Wastes.**

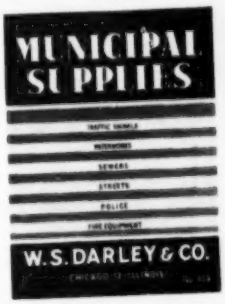
This 2-color bulletin, by means of photographs and text, covers the principal types of equipment made by the company. Among the items discussed are: Primary and Final Clarifiers; Digesters and Heat Exchangers; Rotary Distributors; Plural Alternating Siphons; Rapid and Slow Mixers; Walking Beam Flocers; Pneumatic Ejectors; Sludge Pumps; and Diaphragm and Self-Priming Centrifugal Pumps.

Portable pH Meters

1228

Beckman Instruments, Inc., South Pasadena, Calif., has published a four-page folder on **Beckman Portable pH Meters**—designed to simplify the choice of pH equipment.

Salient performance features and pictures distinguish the four pH meters in the series. They include a highly accurate instrument for laboratory and research studies; a line-operated model for routine measurements in the control laboratory, and two lightweight portables for plant and field applications. The booklet also lists typical industries where these instruments are used.



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W.S. DARLEY & CO., Chicago 12

FOR SALE
New Drosser Couplings
At a Tremendous Saving

190—Coupling 12" C.I. pipe, style #38 ⅜ x 7" M.R. W/O stops, complete W/H.D. bolts, W/O gaskets. Price: **$8.00 ea.**

18—Couplings 44", Steel pipe, style #38, ⅜ x 10" middle ring, W/O stops, complete with hot-dip galvanized bolts, and nuts, W/O gaskets. Price: **$40.00 ea.**

34—Steel pipe armored coupling 44" gaskets, style #38, grade #27. Price: **$6.00 ea.**

DALTON SUPPLY CO.
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INDEX TO ADVERTISERS

A
Amercoat Corporation 89A
American Brass Company 81A
American Car & Foundry Co. 27A
American Concrete Pressure Pipe Ass'n. 121A
American Locomotive Company 119A
*Anthracite Equipment Corp. 125A
Atlas Mineral Products 88A
Aurora Pump Company 82A

B
Badger Meter Mfg. Co. 13A
Bucyrus-Erie Company 6A
Buffalo Meter Co. 21A
Builders-Providence, Inc. 83A-86A

C
Calgon, Inc. 99A
Carborundum Co. 111A
Carlon Products Corp. 113A
Carson Co., H. Y. 125A
Cast Iron Pipe Research Ass'n. 10A-11A
Cement Gun Company 120A
Chapman Valve Mfg. Co. 2nd Cover
*Chicago Bridge & Iron Co. 33A
*Chicago Pump Company 79A
Clark Co., H. W. 112A
Clow & Sons, James B. 20A-116A
Columbia-Southern Chemical Corporation 91A
Combustion Engineering, Inc. 107A
Crane Company 12A

D
Darley & Co., W. S. 127A
Darling Valve & Mfg. Co. 18A
DeLaval Steam Turbine Co. 32A
Dorr Company 3rd Cover
Dresser Manufacturing Division 26A

E
Eddy Valve Company 20A
Electro Rust-Proofing Corp. (N.J.) 94A

F
Fairbanks, Morse & Co. 30A
Fischer & Porter Co. 29A
Flexible Sales Corporation 84A
Foxboro Company 105A

G
General Electric Co. 14A-15A
Grinnell Co., Inc. 17A

H
Hagan Corp. 103A
Hamilton-Kent Mfg. Co. 23A
Hardinge Company, Inc. 116A
Healy-Ruff Company 118A
Hersey Manufacturing Company 16A
Homelite Corp. 101A
Homestead Valve Manufacturing Company 110A
Hydraulic Development Corp. 125A

I
Iowa Valve Mfg. Co. 116A

J
*Johns-Manville 115A-123A

L
Lakeside Engineering Corp. 82A
Layne & Bowler 85A
Leadite Company 118A
Leopold Co., Inc., F. B. 118A
Leupold & Stevens Instruments, Inc. 114A
Link-Belt Company 25A

M
McWane Cast Iron Pipe Co. 122A
*M. & H. Valve Fittings Company 90A
Mathieson Chemical Corp. 4A
Minneapolis-Honeywell Reg. Co. 95A
Morris Machine Works 108A
Mueller Company 93A

N
National Clay Pipe Mfg., Inc. 3A
Neptune Meter Company 34A

P
Pacific Flush Tank Co. 87A
Pacific States Cast Iron Pipe Co. 122A
Pennsylvania Salt Mfg. Co. 117A
*Philadelphia Quartz Company 120A
Phipps & Bird, Inc. 118A
Pipe Linings, Inc. 19A
Pittsburgh Coke & Chemical Co. 31A
*Pittsburgh-Des Moines Steel Co. 109A
Pollard Co., Joseph G. 122A

R
Ranney Method Water Supplies, Inc. 80A
Reliance Chemicals Corp. 122A
Rensselaer Valve Co. 97A
Ridge Tool Company 92A-96A
Roberts Filter Mfg. Co. 122A
Roots-Connersville Blower Division 104A
Royer Foundry & Machine Co. 98A
*R-S Products Corporation 24A

S
*Simplex Valve & Meter Co. 106A
Smith Mfg. Co., A. P. 100A
Smith Co., S. Morgan 22A
Smith & Loveless, Inc. 102A

T
Taylor & Co., W. A. 125A
Tennessee Corporation 82A-122A

U
*U. S. Pipe & Foundry Co. 7A

W
*Wallace & Tiernan Co., Inc. Back Cover
Westinghouse Electric Corp. 8A-9A
*Wilkinson Products Co. 125A
Wood & Co., R. D. 28A

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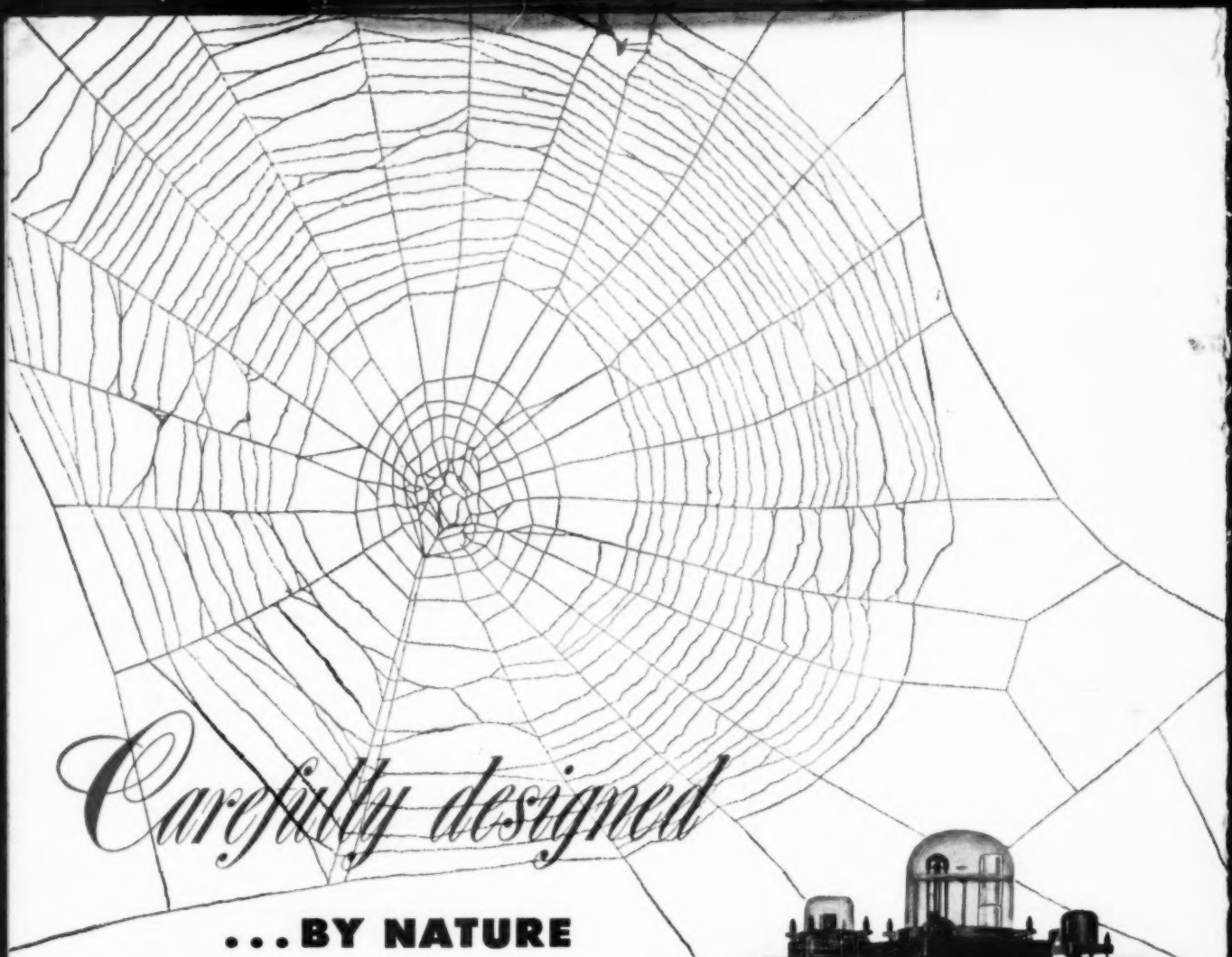

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